ELECTRONIC LOAD

MODEL PLZ50-15A

INSTRUCTION MANUAL

KIKUSUI ELECTRONICS CORPORATION

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.

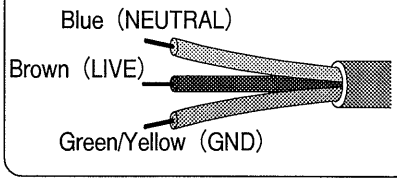
☐ AC power cable

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.

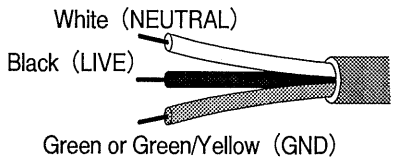
WARNING

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

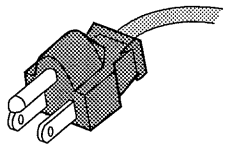
☐ Without a power plug



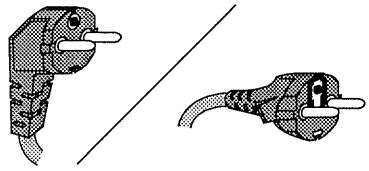
☐ Without a power plug



☐ 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

TABLE OF CONTENTS

1. GENERAL

Kikusui Model PLZ50-15A Electronic Load is a completely electronic device which can be used as a load for an electric power circuit, electric generator, storage battery, or other power source equipment. As well as a resistive load, the Electronic Load can be used as a constant-current load. It can also be used to obtain a constant-current source from a unregulated power source.

When used as a constant-current load, the Electronic Load can be used remote-controlled with an external signal source. This feature is useful especially when the Electronic Load is used as a load device for system measurement.

The Electronic Load is incorporated with various protective circuits to protect both Load itself and power source.

2. SPECIFICATIONS

Model:	PLZ50-15A
Input powerline:	100 V AC ±10%, 50/60 Hz single-phase, approx. 150 VA
Dimensions:	210 W × 140 H × 410 D mm
(Maximum dimensions):	215 W × 165 H × 465 D mm
Weight (net):	Approx. 11 kg
Operation temperature range:	0 ~ 40°C
Accessory:	Instruction manual (1 copy)
Grounding:	"+" or "-" ground (at rear terminal)
Terminals:	Front panel ..... Binding posts Rear panel ..... Terminal board
Floating voltage:	±150 V
Cooling system:	Forced air cooling
Input voltage:	0 ~ 50 V
Input current:	0 ~ 15 A
Input power:	150 W

Operation modes

(1) Constant current mode: 2 ranges (0 ~ 15 A, 0 ~ 1.5 A), continuously variable

(2) Resistance mode: 3 ranges minimum (0.33 Ω, 2 Ω, 10 Ω), continuously variable. (See page 9)

(3) External control mode (constant current mode only):

Input ... 5.5 V maximum

(See Figs. 12 and 14)

Coarse and fine adjustments are possible for the above.

Regulation:

Against line voltage change ..... 0.1% (for ±10% change of input voltage)

Against load change ..... 0.1% (for 0 ~ 100% change of load) (constant current mode)

Ripple noise (5 Hz ~ 1 MHz): 3 mA rms (constant current mode)

5 mA (fixed resistance) (typical value)

Protecting circuits:

(1) Overvoltage protection, approx. 57 V

(2) Overcurrent protection, approx. 16 A

(3) Overpower protection, 200 W or over (See Fig. 18)

(4) Reverse-polarity protection, approx. 0.6 V

(5) Overheat protection

By input circuit breaker trip for all of (1) ~ (5).

Types of operation:

(1) Single-unit operation

(2) One-control parallel operation

(3) Remote control operation (constant-current mode)

Voltmeter: 2 ranges (60V/6V DC), JIS Class 2.5

Ammeter: 2 ranges (15A/1.5A), JIS Class 2.5

Options: Types RMF-41 and RMF-42 Rack Mount Frames (for 2-unit parallel mounting on 19-inch standard rack)

3. EXPLANATION OF PANELS

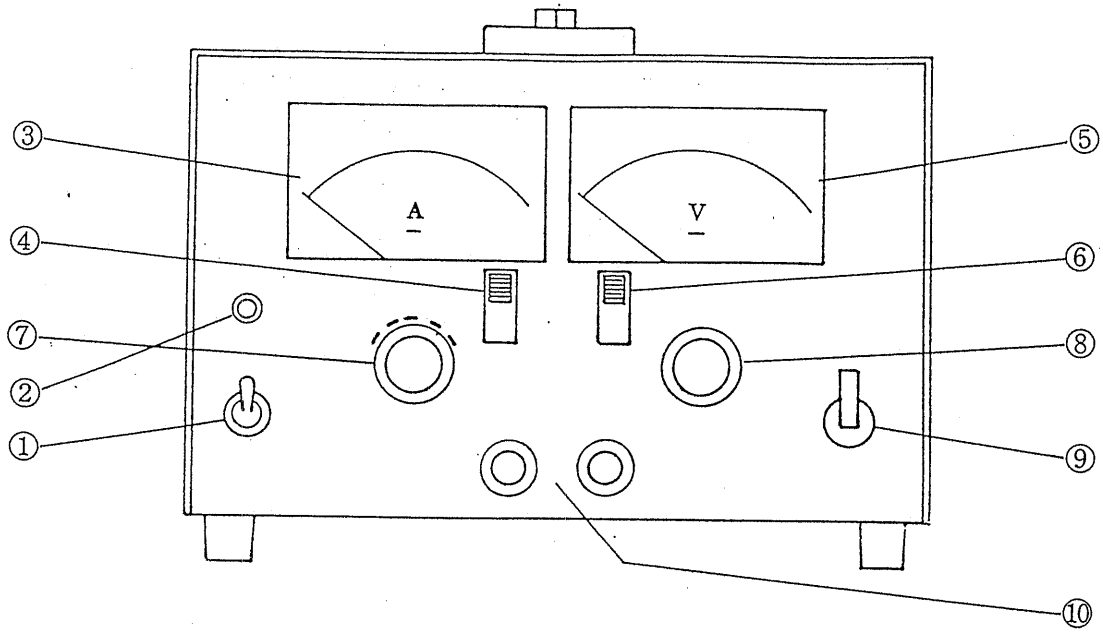


Fig. 1 Front panel

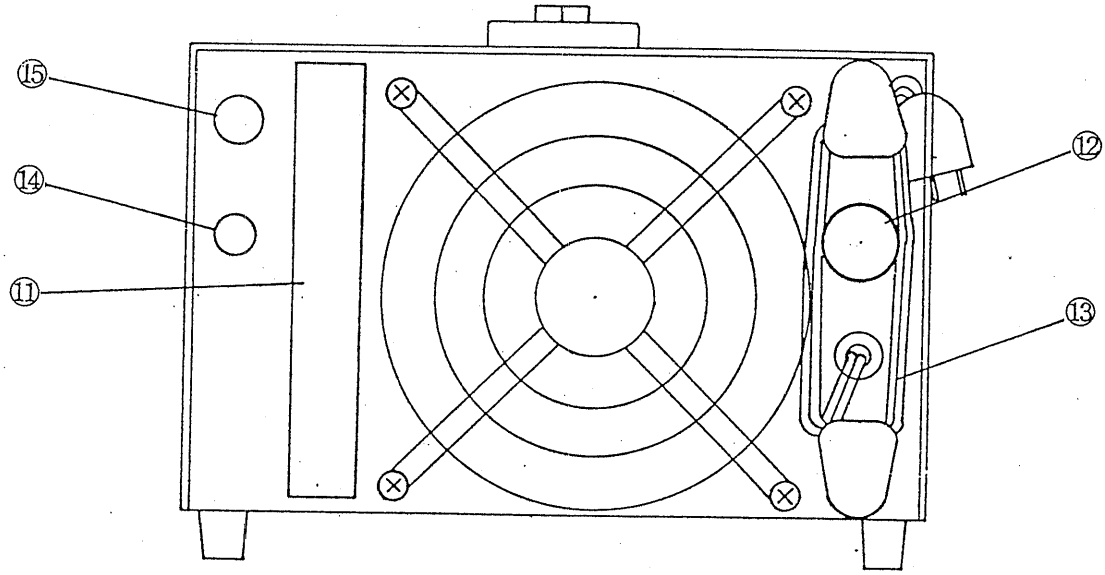


Fig. 2 Rear panel

(1) Power switch:

AC power ON-OFF switch. Upper position is for ON.

(2) Pilot lamp:

AC power pilot light (red LED). Turns-on when power is ON.

(3) Ammeter:

Indicates the DC input current. 1.5 A or 15 A full scale.

(4) Ammeter range selector switch:

Selects ammeter range between 15 A and 1.5 A. Upper position is for 15 A full scale and lower position for 1.5 A full scale.

Note: Note that if the switch is thrown by mistake to the 1.5 A position while it is set in the 15 A position for measurement of a current near the full scale, the meter pointer will deflects over the full scale and the meter accuracy may be adversely affected.

(5) Voltmeter:

Indicates the DC input voltage. 6 V or 60 V full scale.

(6) Voltmeter range selector switch:

Selects the voltmeter range between 60 V full scale (upper position) and 6 V full scale (lower position). Voltage setting of the

overvoltage protection circuit automatically changes in conformity with setting of this switch.

⑦ Function selector switch:

Selects the operation mode of the Electronic Load.

⑧ Load adjustment knobs:

Adjust the current, resistance for each operation mode. The outer knob is for coarse adjustment and the inner knob for fine adjustment. As the knobs are turned counterclockwise, the current increases and the resistance decrease.

⑨ Load switch:

A circuit breaker for ON-OFF control of the DC input. The breaker automatically trips when the overvoltage, overpower, reverse-polarity or overheat protection circuit has operated.

⑩ Input terminals:

Binding post terminals for DC input. The lef-hand one (white) is for negative line and the right-hand one (red) for positive line.

⑪ Terminal board:

Terminals for input, parallel operation, remote control and external control are mounted on the terminal board at rear panel. (See Fig. 3)

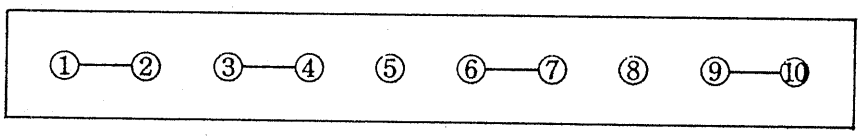
⑫ Fuse:

3-ampere fuse in the primary line of the AC input power transformer.

⑬ Input power cord:

AC power input power cord with plug. Connect this cord to an AC line outlet of the specified voltage. Cord hooks are provided to take up the cord when carrying the device.

Fig. 3 Terminal board at rear panel



① Input "+"

② Input voltmeter "+"

③ Input voltmeter "-"

④ Input "-"

⑤ External control signal input terminal

⑥ , ⑦ Remote-control, one-control parallel operation terminals

⑧ One-control parallel operation terminal

⑨ , ⑩ Remote control terminals

* Terminals between ① - ②, ③ - ④, ⑥ - ⑦, ⑨ - ⑩ are electrically shorted with shorting chips. When operating the device, ensure that these shorting chips are securely tightened.

⑭ GND terminal:

This ground terminal is connected to the chassis.

⑮ Remote control terminal:

This terminal is used for controlling the device with an external potentiometer instead of that on the front panel of the device.

4. OPERATION METHOD

4.1 Notes in Using the Electronic Load

The PLZ50-15A Electronic Load is a particular type of electronic load device which is incorporated with an internal drive power source so that the device can be operated with an input voltage of higher than zero volts. (Keep the input voltage higher than zero volts.) The input circuit breaker may trip in any of the following cases:

(a) No signal (power) is connected to the input terminals.

(b) No input current flows although a power source or other signal is connected to the input terminals. (For example, when no current flows as the current control knob of the power source is set in the minimum position.)

(c) The voltage at the input terminals is lower than approximately -0.6 V due to low source voltage and large voltage drop in lead wires.

For the lead wires, use wires as large as possible (cross section area 8 cm^2 or over) and as short as possible (not longer than 2 meters). Strand the two lead wires securely. Do not connect a capacitor directly across the input terminals of this device. The capacitor connected between the input terminals may cause oscillation.

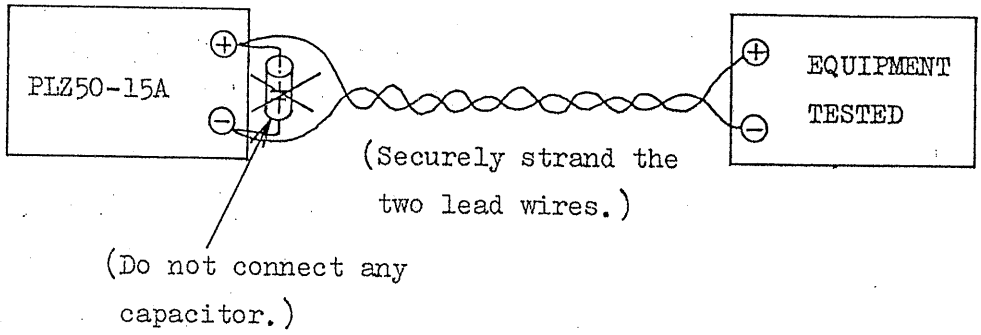


Fig. 4

(1) Input powers:

The AC input power for the device is 100 V ±10%, 48 ~ 62 Hz.
The DC input for the device must not exceed 150 W.

(2) Conditions of use:

Never use the device in any of the following conditions:

- Place where the device is subjected to direct radiation from a heat source.
- Place where ambient temperature is not within 0 ~ 40°C.
- Place where is dusty or damp.
- Place where the floor is not level.

Do not operate the device being laid on its side or with other object put on the device, lest air ventilation should be impeded and troubles should be caused.

When two or more devices are used being stacked up or mounted on a rack, pay attention to ventilation and provide 50 mm or over of spacing between top and bottom of two mutally adjacent units.

When connecting a DC source to the device, be sure to turn-on the power switch after securely connecting the power line.

4.2 FUNCTION Switch

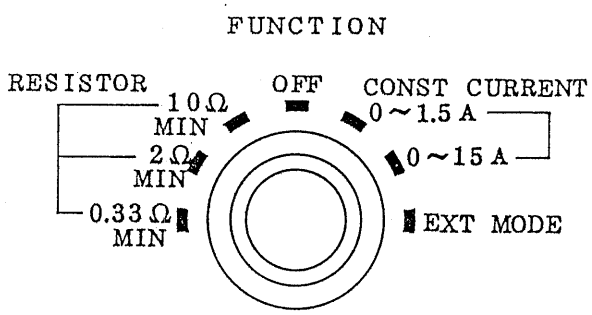


Fig. 5 FUNCTION switch

The FUNCTION switch is for selecting the required operation mode of the device, as shown in Fig. 5. Details of the operation modes are explained at a later part in this instruction manual.

Note: Be sure to turn-OFF the load switch (9) before turning the FUNCTION switch.

4.3 CONSTANT CURRENT Operation

4.3.1 To Use the Device as Constant Current Load

To use the device for constant-current discharge test of a storage battery equipment or for load test of a power supply equipment, proceed as follows:

(1) Set the FUNCTION switch in the CONSTANT CURRENT 0 ~ 1.5 A or 0 ~ 15 A position.

(2) Keeping the LOAD switch in the OFF state, connect the tested equipment. (When connecting the equipment, ensure that the lead wires are connected in the correct polarity.) As the voltmeter will deflect when this is done, set the range at an appropriate value if the voltage is predictable or at a higher range if the voltage is not predictable.

(3) Turn-ON the LOAD switch and turn clockwise the LOAD knob so that a constant current flows in the device and the ammeter indicates the current value. (See Fig. 6)

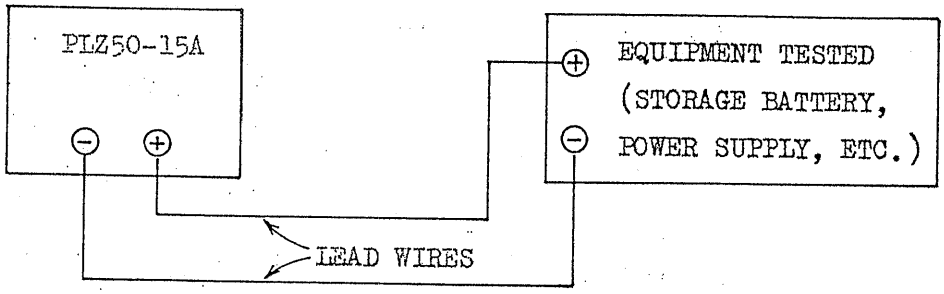


Fig. 6

* When the device is operated at a large current, the voltage indicated by the voltmeter may become meaningfully lower than the actual voltage at the tested equipment due to the voltage drop in the lead wires. In such a case, to measure more accurately the voltage at the tested equipment, the voltmeter can be directly wired to the tested equipment. For this measurement, proceed as follows: Disconnect the shorting bars from terminals between ① - ② and between ③ - ④. Connect terminals ② and ③ to the tested equipment, with terminal ② for "+" and terminal ③ for "-". With this setup, the voltmeter indicates the voltage of the tested equipment eliminating the error caused by the voltage drop in the lead wires.

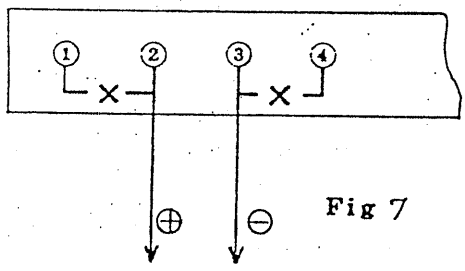


Fig 7

Fig. 7

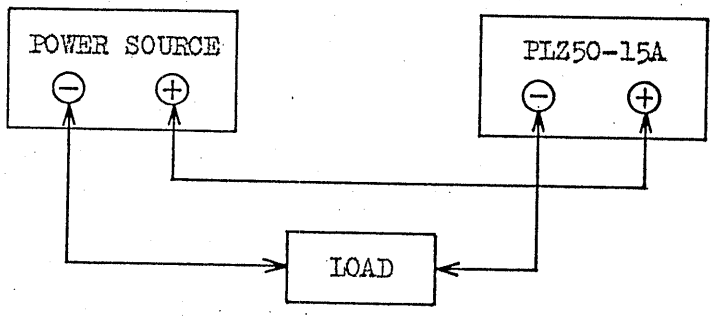
* The set current value of the device is not affected by the voltage drop caused by the lead wires so far as the input voltage is not lower than 0 V.

* When the LOAD switch has tripped while in operation, check the cause (operation of the overvoltage, overpower, or other protection circuit) and, then, turn-on the switch.

4.3.2 To Use the Device as Constant Current Source

A constant current source can be readily obtained by using a power source and this device. (See Fig. 8)

(1) Connect the possitive (+) terminal of the power source to that of this device. Connect the negative (-) terminal of the device to the positive terminal (+) of the load and connect the negative terminal (-) of the power source to the negative terminal (-) of the load.



Ensure that the polarities are correct.

Fig. 8

4.4 RESISTOR Operation

By setting the FUNCTION switch in the RESISTOR position, the device can be used as a fixed resistance load (in three minimum-resistance ranges of approximately 0.33 Ω, 2 Ω, or 1 Ω). As you turn the LOAD knob counterclockwise, the resistance increases as follows:

0.33 Ω range:	Approx. 5 kΩ at 5 V
	Approx. 6 kΩ at 50 V
2 Ω, 10 Ω ranges:	Approx. 6 kΩ at 5 V
	Approx. 7 kΩ at 50 V

* Note that the constant-current feature may not be maintained when the input voltage has become lower than 0 V.

* The load switch may trip while in operation. In such a case, check the cause of the trouble (overvoltage, overpower, etc.) and turn-on the switch after checking the cause of the trip.

The relationship of resistance vs. input voltage is shown in Fig. 9.

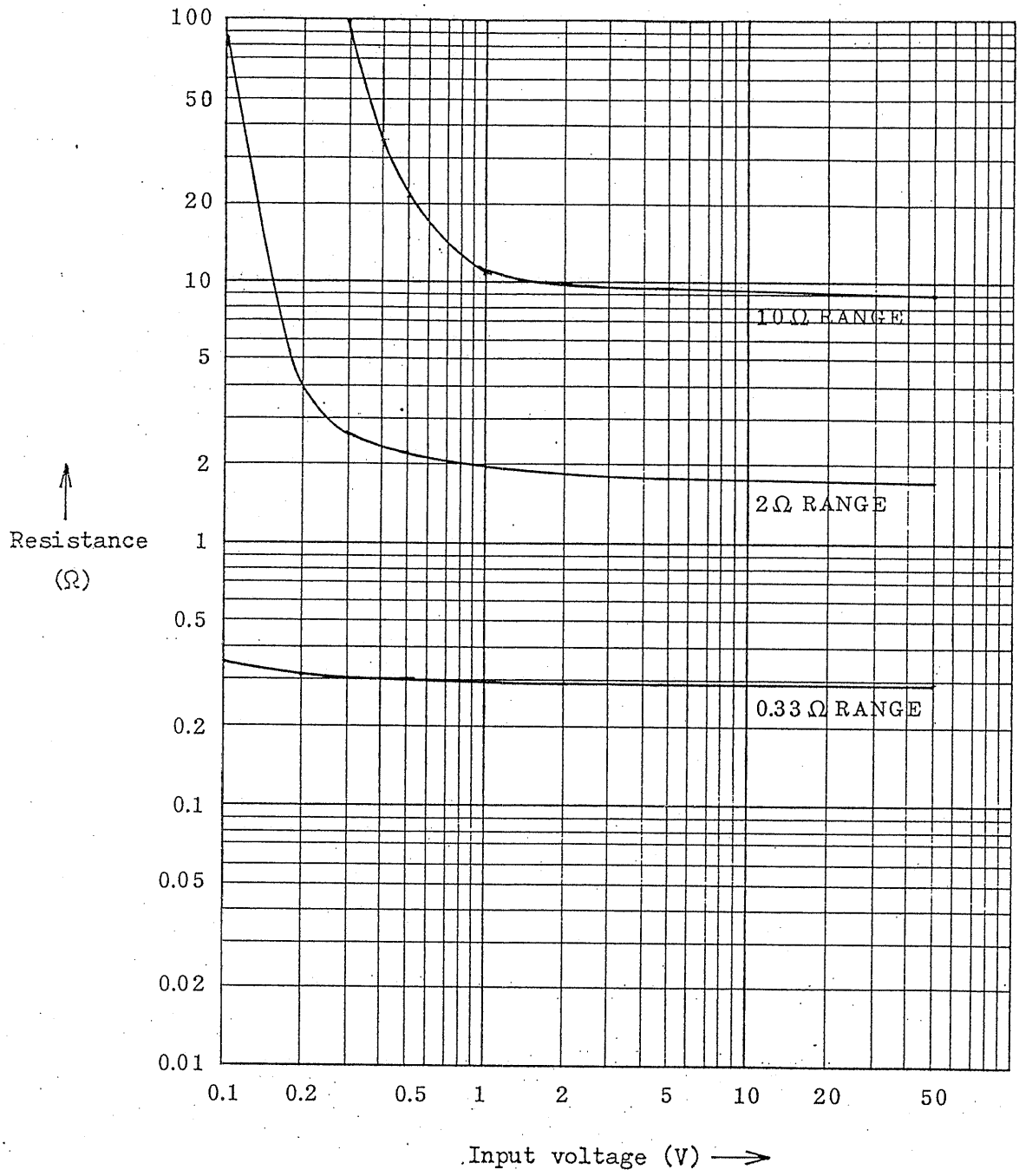


Fig. 9 Input voltage vs. resistance

4.5 EXT MODE Operation

This mode is used when an external power is supplied and the output is required to be controlled irrespective of the LOAD knob on the front panel or when the current consumption is required to be controlled with various waveforms.

For operation in this mode, apply a signal between terminal 4 (-) and terminal 5 (+) as shown in Fig. 10. With this setup, the device operates in the constant-current mode. The input resistance in this case is approximately 15 kΩ.

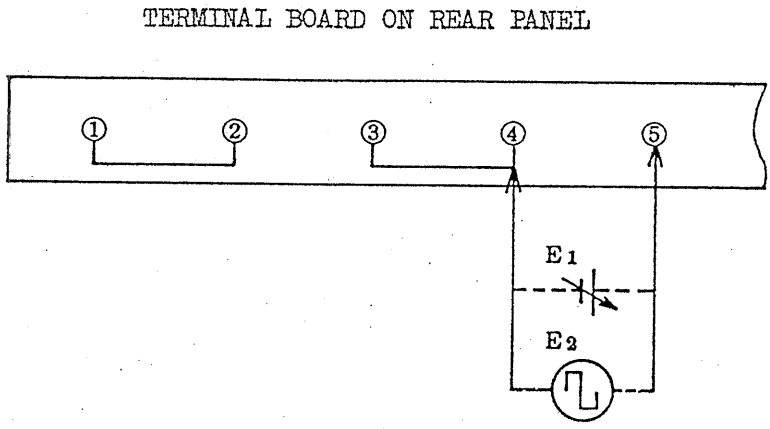


Fig. 10

4.5.1 Control with DC Voltage

Connect a variable DC voltage source (E_1) as shown in Fig. 10. With this setup, when the LOAD knob on the front panel is set in the extremely clockwise position and an input voltage of 5.5 V

is applied, the current becomes approximately 15 A. When the voltage is 2.75 V, the current becomes approximately 7.5 A as shown in Fig. 11. By turning counterclockwise the LOAD knob, the current for 5.5 V input voltage can be reduced to lower than 15 A.

When setting is made as represented with line 2 in Fig. 11, the current for 5.5 V becomes 10 A and that for 2.75 V becomes 5 A.

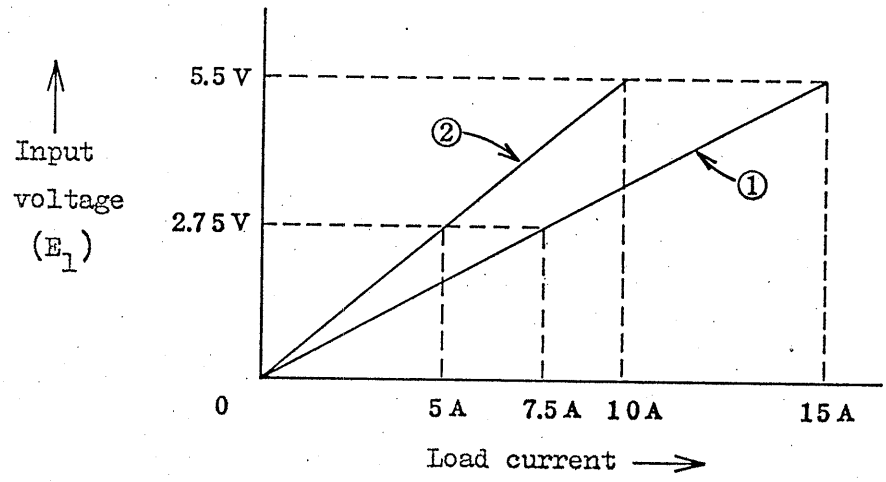


Fig. 11

When controlled with an external DC voltage, the load current is proportional to the external DC voltage. At the low input level range, however, the linearity is slightly degraded as shown in Fig. 12.

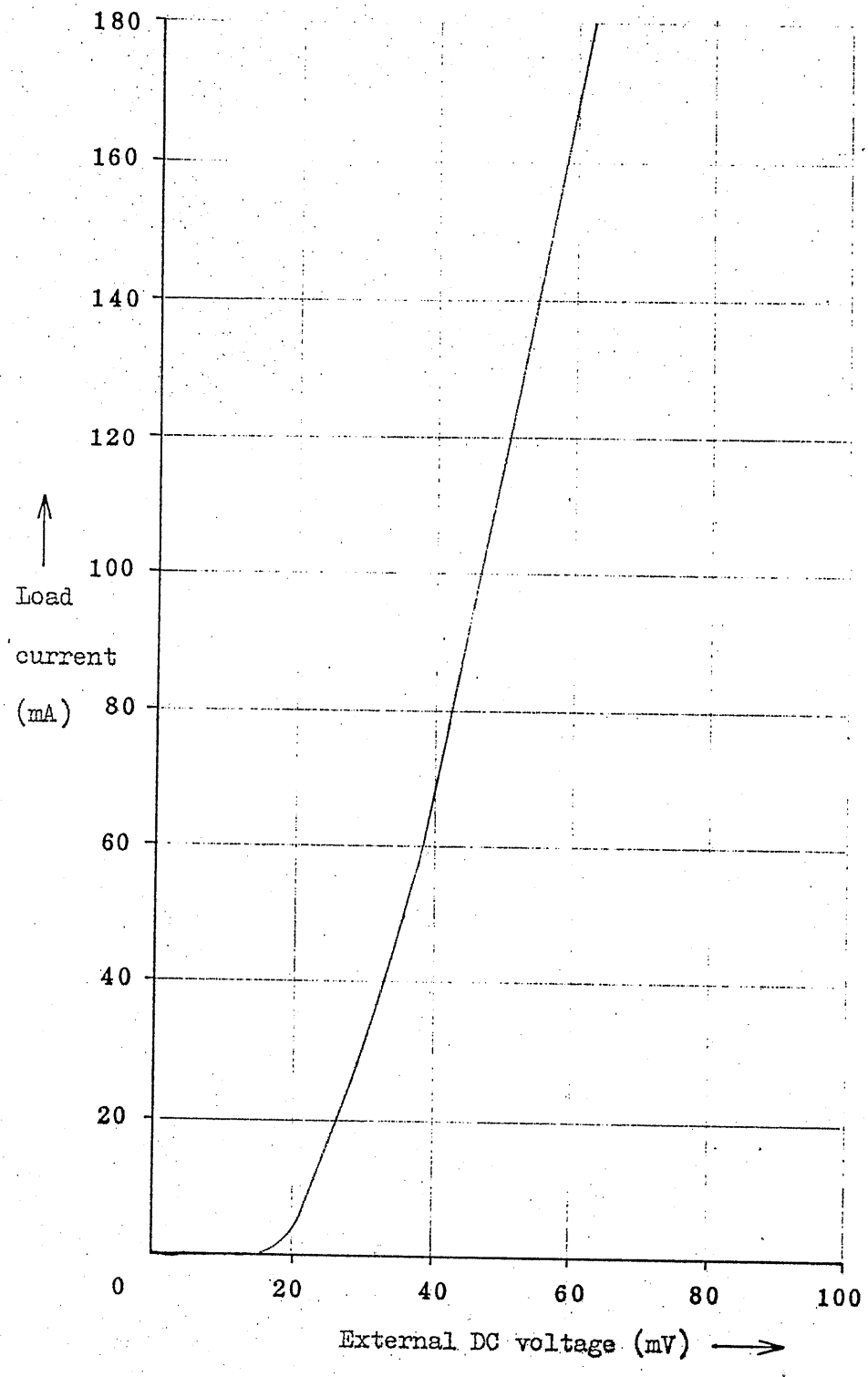


Fig. 12 External DC voltage vs. load current characteristics at low level range

4.5.2 Control with External Signal of Various Waveforms

The current of the device can be controlled with an external signal of various different waveforms as well as with DC signal. For this operation, connect E_2 instead of E_1 in Fig. 10. A signal of any waveform can be used -- sinusoidal, saure, triangular, etc. Note, however, that the current is controllable only within the positive range of the oscillator output. (See Fig. 13)

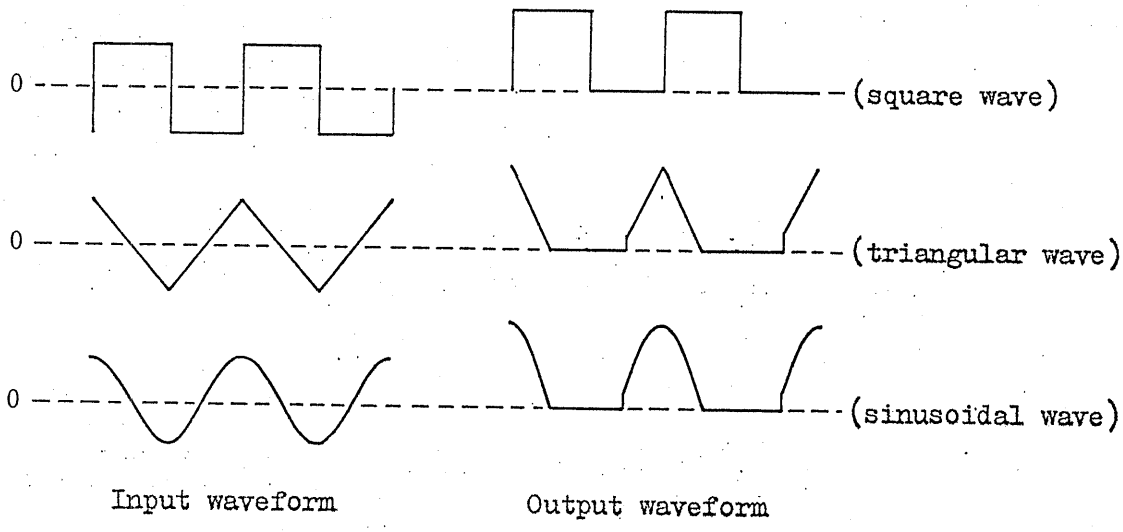


Fig. 13

Connect a resistor in series with the device and apply the external signal across this resistor. Note that, when modulating with a square wave, the resistance of the series resistor should be as small as practicable. If the resistance is large, the rise-up and fall-down characteristics of the load current may be degraded. Both rise-up and fall-down periods are approximately 35 sec when the series resistance is small with respect to an input voltage of approximately 5 ~ 50 V.

If the input voltage is lower than 5 V, overshoots may be caused or the rise time characteristics may be degraded or other unfavorable effects may be caused depending on the load current. To vary the load current, vary the oscillator output while keeping the LOAD knob constant in the maximum position.

* Note that the sum of the peak value of the input waveform and the value of the DC bias must not exceed 5.5 V.

* Note that the power of the device must not exceed 150 W p-p. Also note that, when the device is operated with a signal frequency of 100 Hz or over, the breaker may fail to trip in response to a peak-to-peak overpower state.

The frequency response characteristics of the device when used in the EXT mode are as shown in Fig. 14.

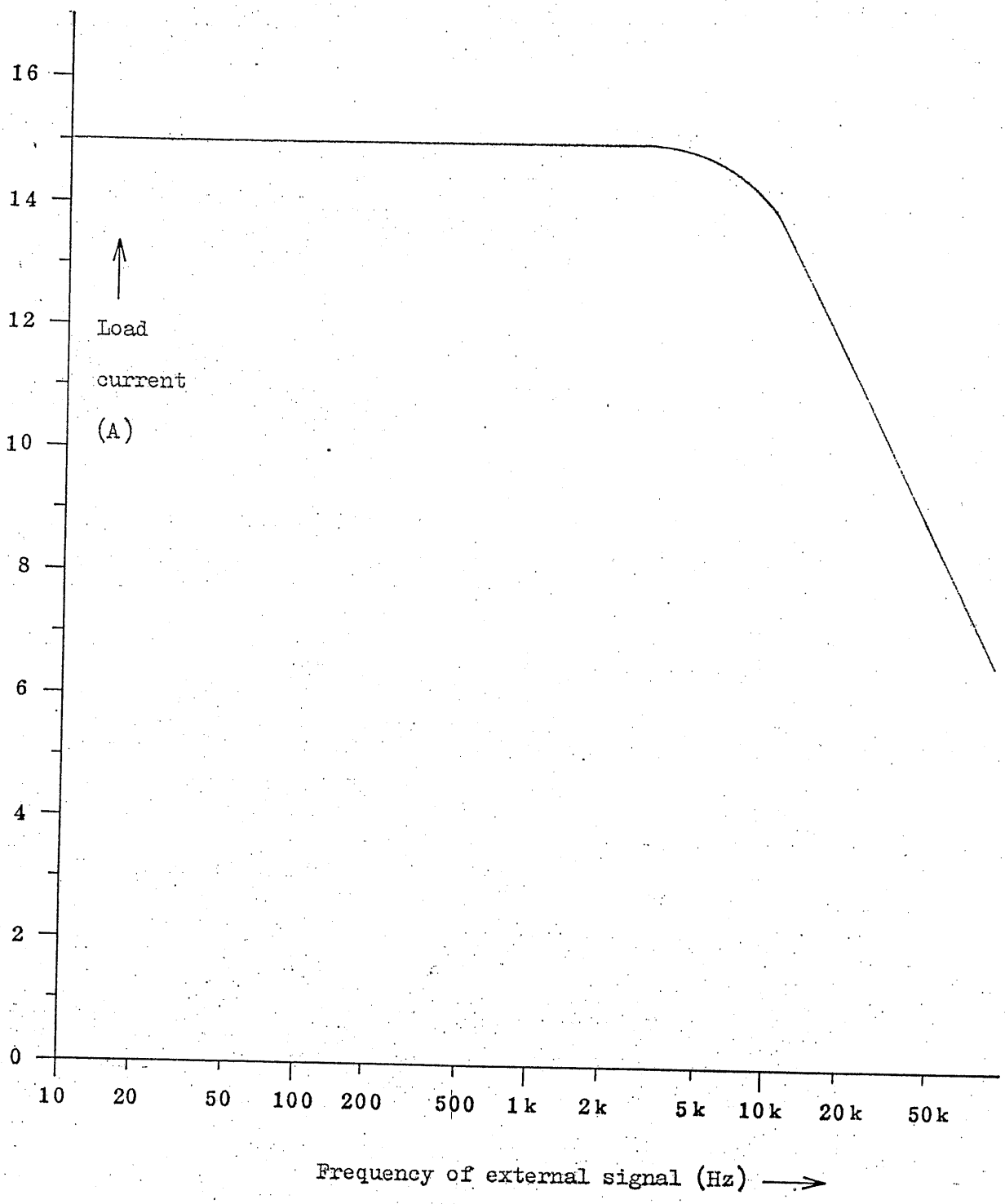


Fig. 14

4.6 One-control Parallel Operation

Two or more units can be connected in parallel to increase the current rating or power rating (in the RESISTOR or CONSTANT CURRENT mode operation). For parallel operation, it also is possible to use one of the two or more unit as a master unit and to use the other unit as a slave unit as well as it is possible to connect the two units simply in parallel.

(1) To operate three units in parallel, connect the terminals of the rear panels as shown in Fig. 15. (To operate two units in parallel, eliminate the connections indicated with the dotted lines.)

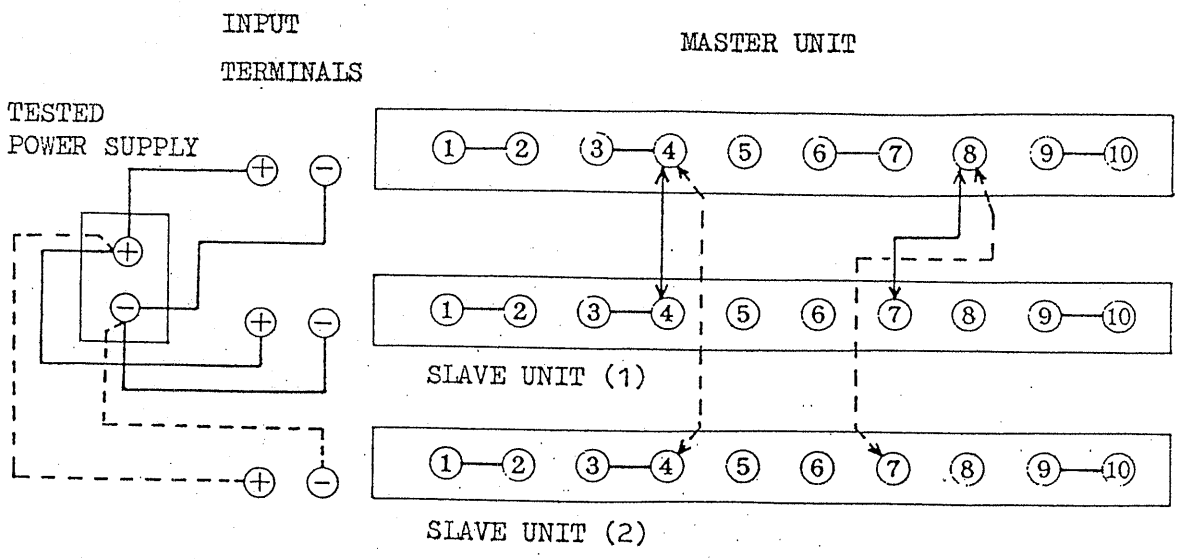


Fig. 15

* Be sure to connect the lead wires to the PLZ50-15A units directly from the power source as shown in Fig. 15.

(2) Turn-on the power source switch and the load switches of the slave units.

(3) Turn-on the load switch of the master unit, and the current will flow.

(4) All operations are controlled with the master unit.

(5) To finish the operation, turn-off at first the switch of the master unit and next the switches of the slave units. The current is cut out when the switch of the master unit is turned off.

* The protection circuits of individual units operates mutually independently.

* Connect the terminals of the rear panels with lead wires of the minimum lengths.

* The current of each slave unit is adjustable with its LOAD control knob (red FINE control knob). Keep this knob in the minimum current position in order to keep the balance of the master and slave units.

4.7 Remote Control Operation

The device can be remote-controlled with an external DC voltage signal as explained in the above. The device also can be controlled with a resistance signal as follows:

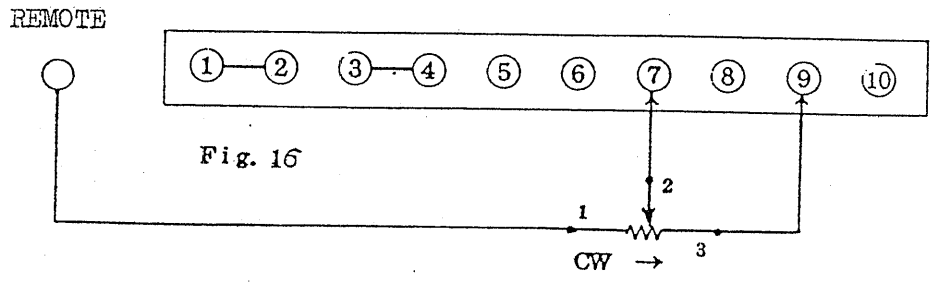


Fig. 16

Fig. 16

(1) Connect a variable resistor (1.5 kΩ) as shown in Fig. 16.

(2) When the variable resistor is used at a distance from the device, use a shielded cable in order to guard against degradation of ripple and other characteristics due to external induction noise.

* The device has been calibrated for a variable resistor of 1.5 kΩ. If no variable resistor of this resistance is available, connect a compensating resistor in parallel or series as shown in Fig. 17 in order that the total resistance becomes 1.5 kΩ. When using a parallel compensating resistor, note that the device characteristics may be degraded if the resistance of the variable resistor is 5 kΩ or higher. When

using a series compensating resistor, note that the controllable range will become narrower.

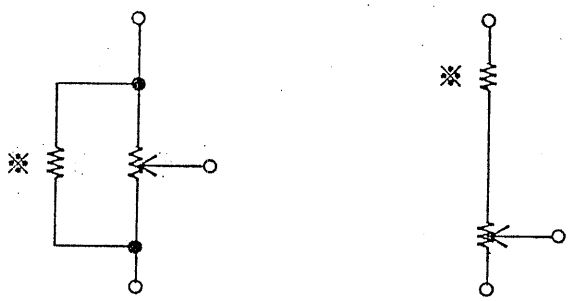


Fig. 17

4.8 Protection Circuits

The device is incorporated with full protective features as mentioned in the following.

4.8.1 Overvoltage Protection Circuit

This circuit protects the device against overvoltage, by turning-off the load switch. The protection limit voltage is approximately 60 V or 6 V, as switched in gang with the voltmeter range selector switch.

4.8.2 Overpower Protection Circuit

The device is designed for 150-watt heat dissipation. If the power exceed this limit, the power transistors may be damaged.

This circuit protects the device by tripping the load switch when the power has exceeded the area indicated with the dotted lines in Fig. 18. Since the device is designed for 150 watts, operate with a power within the shaded area in Fig. 18. If a larger power is required, use two or more units in parallel.

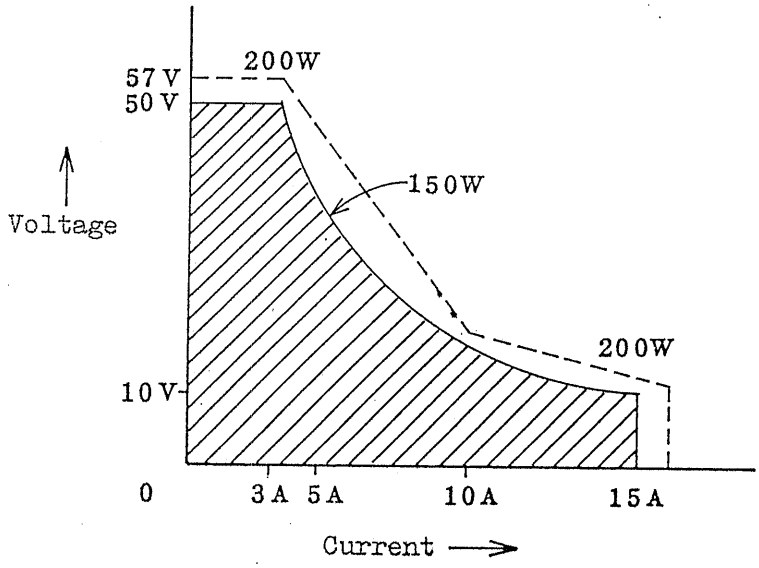


Fig. 18

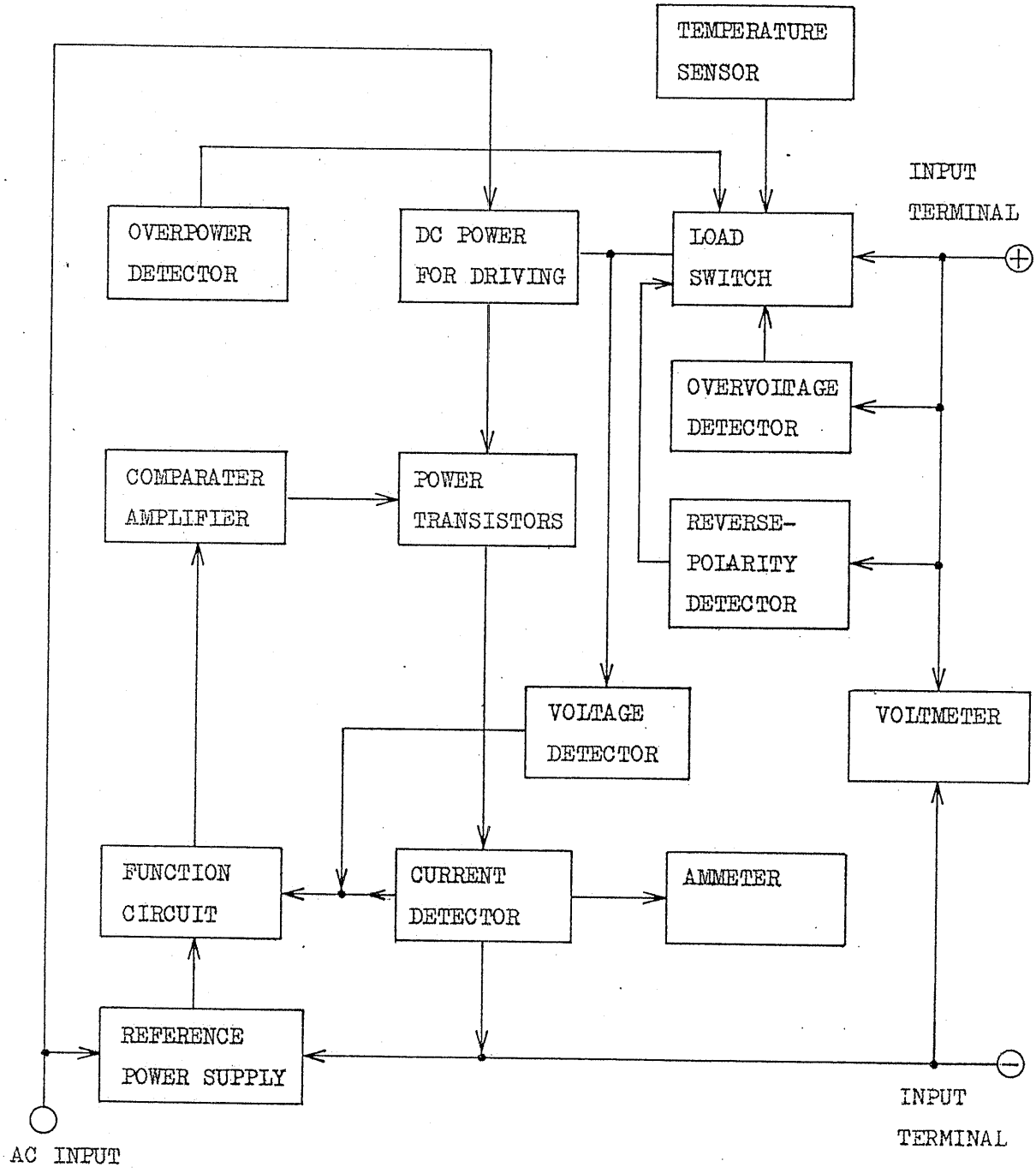
4.8.3 Reverse-polarity Protection Circuit

This circuit trips the load switch when the input power (with a voltage of approximately 0.6 V or over) is applied in the reverse polarity.

4.8.4 Overheat Protection Circuit

Even when the device is operated within its ratings, the internal temperature of the device may become untolarably high due to imperfect ventilation as mentioned in Item 4.1 (1) or other causes. This circuit trips the load switch when the internal temperature of the device has risen above the tolerable limit. The device can be re-started by turning-on the load switch when the device is cooled off.

When any of the above-mentioned protection circuits has tripped, check and eliminate the cause of the trouble and, then, turn-on the power. When the load switch has tripped as mentioned in Para. 4.8.4, cool off the instrument and, then, turn-on the switch. Unless the unit has been cooled off, the switch may trip again at the instant it is turned on.



Block diagram of PLZ50-15A Electronic Load