# INSTRUCTION MANUAL

# ELECTRONIC LOAD

# MODEL PLZ50-50

KIKUSUI ELECTRONIC 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.

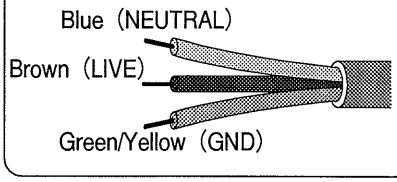
☐ AC power cable

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.

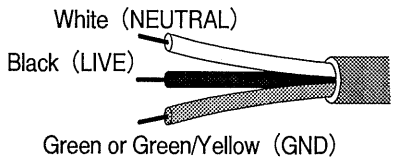
**WARNING**

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

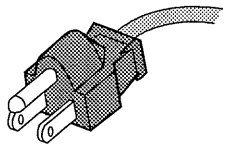
☐ Without a power plug



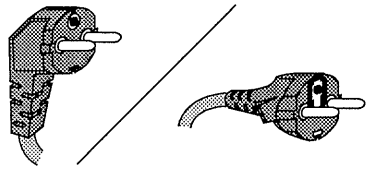

☐ Without a power plug




☐ 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

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# 1. GENERAL

Kikusui Model PLZ50-50 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 an unregulated power source.

When used as a constant-current load, the Electronic Load can be 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. Furthermore, the Load is incorporated with a fan for forced air cooling, making itself less overheated and ensuring a safer operation.

## 2. SPECIFICATIONS

| | |
|---|---|
| Model: | PLZ50-50 |
| Line power requirements: | 100 V ±10%, 50/60 Hz single-phase AC, approx. 40 VA |
| Dimensions: | 210 W × 140 H × 410 D mm (8.27 W × 5.51 H × 16.14 D in.) |
| (Maximum dimensions): | 215 W × 165 H × 465 D mm (8.47 W × 6.50 H × 18.31 D in.) |
| Weight (net): | Approx. 9.5 kg |
| Operation temperature range: | 0 to 40°C (32°F to 104°F) |
| Accessory: | Instruction manual (1 copy) |
| Grounding: | "+" or "-" ground (at rear panel) |
| Terminals: | Front panel ..... Threaded posts (M6 screws)<br>Rear panel ..... Terminal board |
| Withstanding voltage against ground: | ±150 V |
| Cooling system: | Forced air cooling |
| Input voltage: | 3 - 50 V |
| Input current: | 0 - 50 A |
| Input power: | 300 W |

Operation modes

(1) Constant current mode: 2 ranges (0 - 50 A, 0 - 5 A) continuously variable

(2) Resistance mode: 3 ranges minimum (0.1Ω, 1Ω, 8Ω) continuously variable

(3) External control mode (constant current mode only): Input ..... 5.5 V maximum

Coarse and fine adjustments are possible for the abobe.

Regulation:

Against line voltage change...0.1% (for ±10% change of line voltage) (constant current mode)

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

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

Protecting circuits:

(1) Overvoltage protection, approx. 55 V
(2) Overcurrent protection, approx. 54 A
(3) Overpower protection, approx. 300 W (See Figure 14.)
(4) Reverse-polarity protection
(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 (60A/6A DC), 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

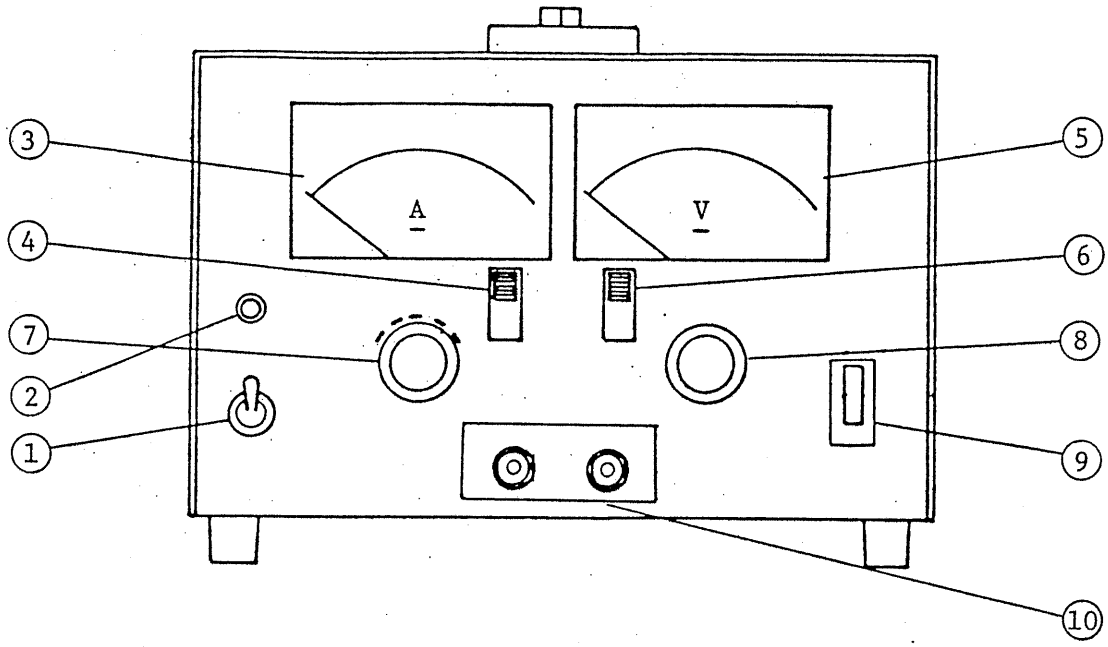



Figure 1. Front panel

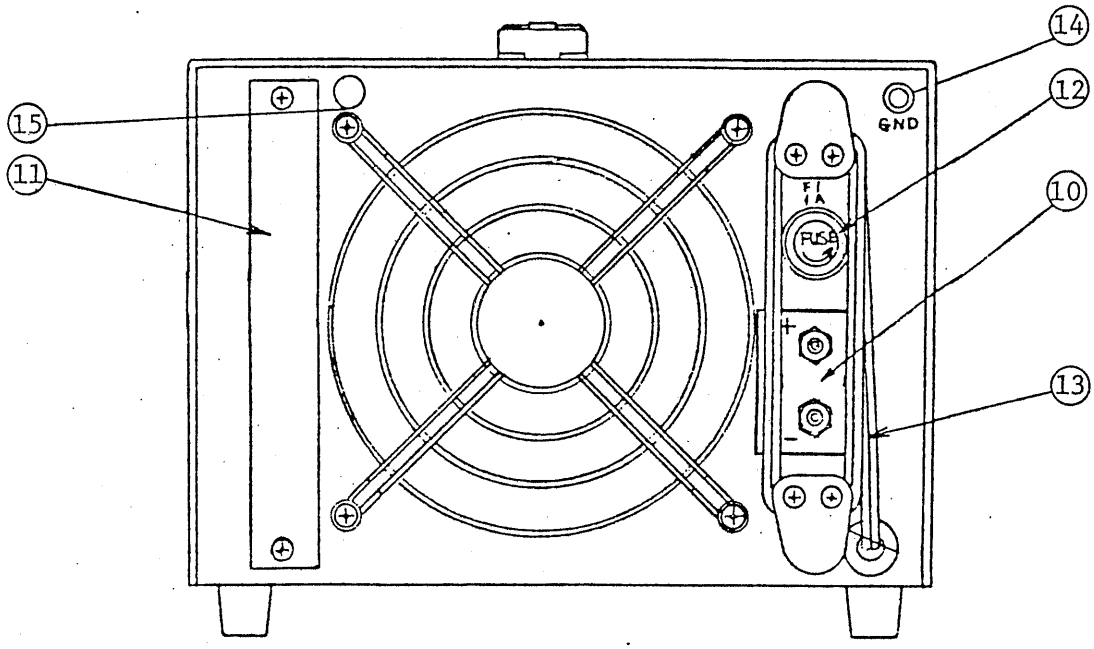



Figure 2. Rear panel

(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. 60 A full scale.

(4) Ammeter range selector switch:

Selects ammeter range between 60 A and 6 A. Upper position is for 60 A full scale and lower position for 6 A full scale.

Note: Note that if the switch is thrown inadvertently to the 6 A position when it is set in the 60 A position for measurement of a current of 50 A or thereabout, the meter pointer will deflects over the full scale and the meter accuracy may be adversely affected.

(5) Voltmeter:

Indicates the DC input voltage. 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 and voltage 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 and voltage 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 tripped.

(10) Input terminals:

Threaded post terminals (M6 bolts) for DC input. The left-hand one (white) is for negative line and the right-hand one (red) for positive line. For connections, use solderless terminals (crimping lug terminals) and fix them securely to the M6 bolt terminals using a wrench.

(11) Terminal board:

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

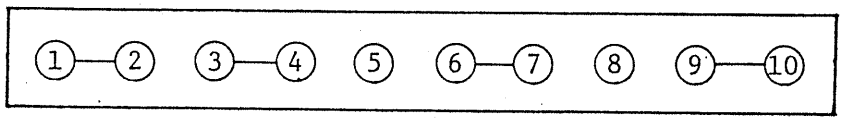
(12) Fuse:

Fuse (1 ampere) in the primary line of the AC input power transformer

(13) Input power cord:

AC 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.

Figure 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
7 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, make it sure 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. (See Figure 12.)

# 4. OPERATION METHOD

## 4.1 Notes for Using the Electronic Load

(1) Input powers:

The AC input power for the device must be 100 V ±10%, 48 - 62 Hz. Allow a stabilization time of 5 to 10 minutes after turning on the power. The DC input power for the device must not exceed 300 W.

(2) Conditions of use:

Never use the device in any of the following conditions:

- o A place where the device is subjected to direct radiation from source of heat.
- o A place where ambient temperature is not within 0 - 40°C (32°F - 104°F).
- o A place where is dusty or damp.
- o A 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 blocked.

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 DC source.

## 4.2 FUNCTION Switch

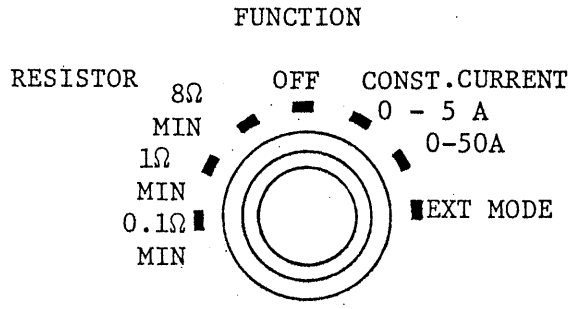



Figure 4

The FUNCTION switch is for selecting the required operation mode of the device, as shown in Figure 5. Details of the operation modes are explained at a later part of 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 - 5 A or 0 - 50 A position.

(2) Keeping the LOAD switch in the OFF state, connect the equipment to be tested. (When connecting the equipment, ensure that the leadwires 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 unpredictable.

(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 Figure 5.)

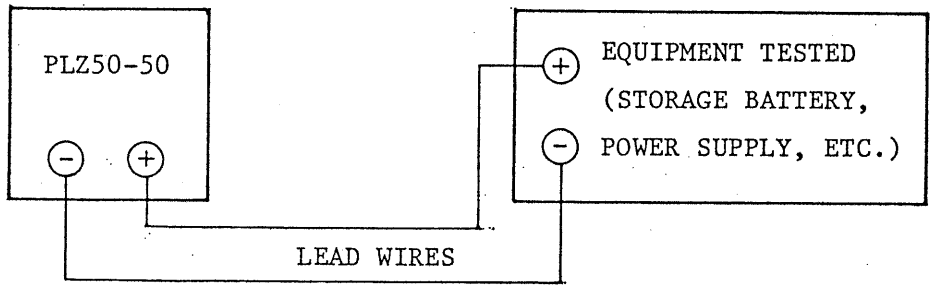



Figure 5

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

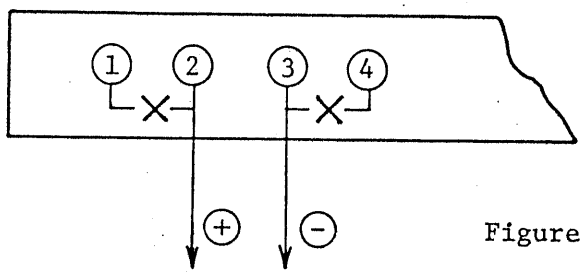



Figure 6

EQUIPMENT TESTED

* When in the above mode, the set current of the device is not affected by the voltage drop caused by the leadwires so far as the input voltage is not lower than 3 V.

* When the LOAD switch has tripped due to the operation of the overvoltage, overpower, or other protecting circuit, check and eliminate the cause 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 Figure 7.)

(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.

(2) In this case also, the LOAD switch trips depending on the voltage or wattage applied to the PLZ50-50.

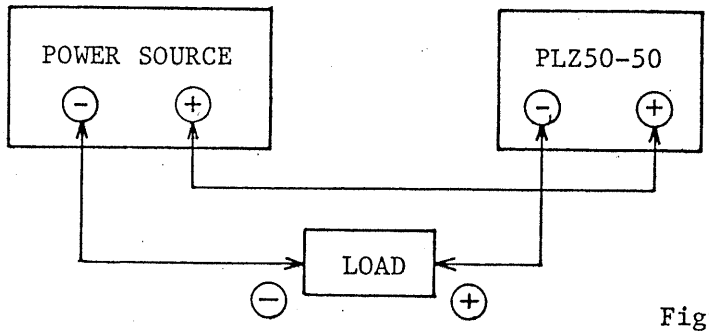



Figure 7

Make it sure that the polarities are correct.

## 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 0.1Ω, 1Ω, and 8Ω). As you turn the LOAD knob counterclockwise, the resistance increases toward the maximum resistances as follows:

| | | |
|---|---|---|
| 0.1Ω range: | Approx. 3 k | at 5 V |
| | Approx. 7 k | at 50 V |
| 1Ω, 8Ω ranges: | Approx. 4 k | at 5 V |
| | Approx. 13 k | at 50 V |

* Note that the constant-current feature may not be maintained when the input voltage has become lower than 3 V.

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

## 4.5 EXT MODE Operation

This mode is employed when, by applying an external voltage, 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 for various waveforms.

For this mode of operation, apply a signal between terminal 4 (-) and terminal 5 (+) as shown in Figure 8. With this setup, the device operates in the constant-current mode. The input resistance in this case is approximately 15 kΩ.

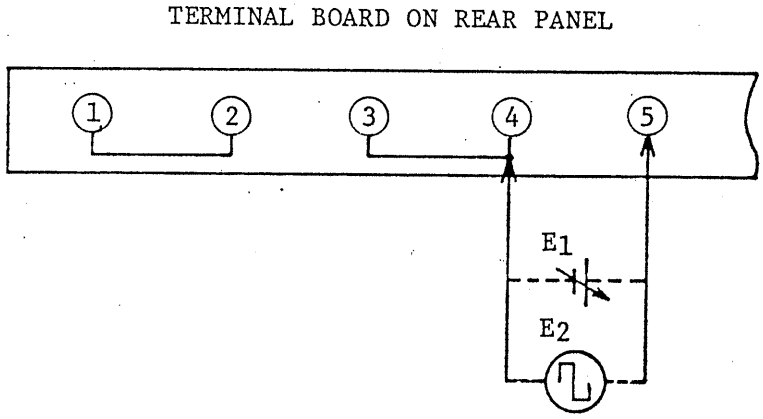



Figure 8

### 4.5.1 Control with DC Voltage

Connect a variable DC voltage source ($E_1$) as shown in Figure 8. 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 50 A. When the voltage is 2.75 V, the current will be approximately 7.5 A as shown in Figure 9. By turning the LOAD knob counter-clockwise, the current for 5.5 V input voltage can be reduced to lower than 50 A.

When setting is made as represented with line 2 in Figure 9, the current for 5.5 V becomes 32 A and that for 2.75 V becomes 16 A.

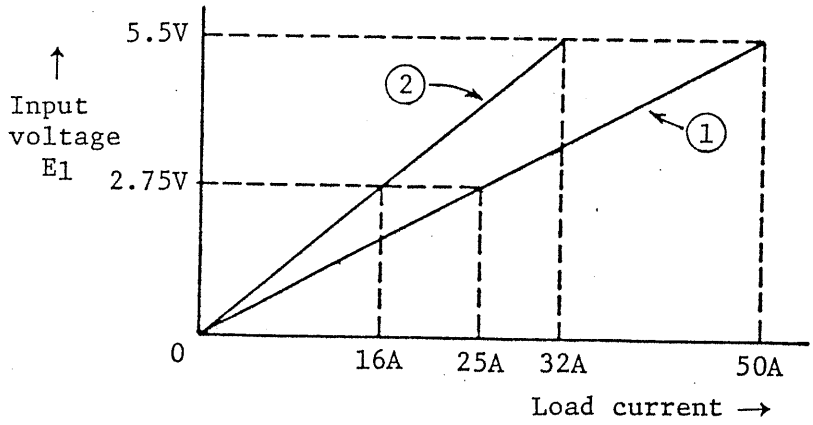



Figure 9

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 Figure 9. A signal of any waveform can be used -- sinusoidal, square, triangular, etc. Note, however, that the current is controllable only within the positive range of the oscillator output. (See Figure 10.)

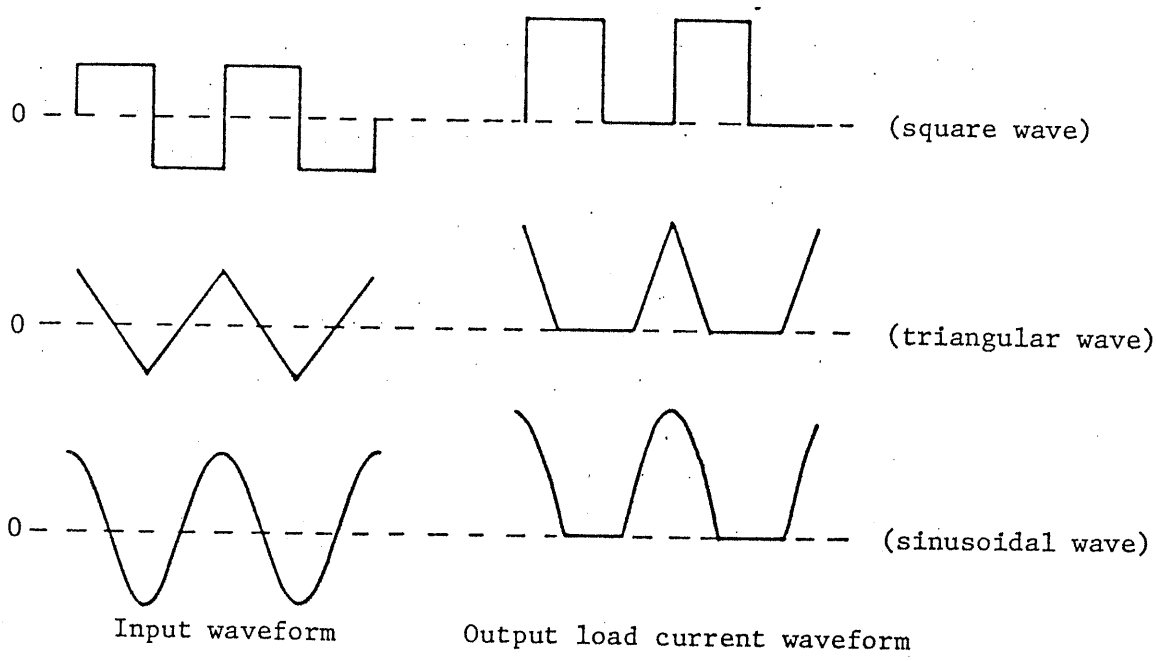



Figure 10

When controlling the load current with a square wave, if the DC input voltage is low (lower than approximately 6.5 V), overshoots may be caused or the rise time characteristics may be degraded or other unfavorable effects may be caused. Be sure to set the DC input voltage not lower than 6.5 V. To vary the load current, vary the oscillator output while keeping both LOAD knobs constantly in the maximum position. The rise or fall time is approximately 60 μsec.

If overall waveform of the input signal waveform is required to be reproduced in the output waveform without clamping of the lower half, this can be done by superimposing a DC bias voltage on the input signal. This DC bias voltage must be greater than one-half of the peak-to-peak voltage of the input signal.

* Note that the power of the device must not exceed 300 W peak. 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.

## 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 units as a master unit and to use the other unit as a slave unit as well as it is possible to connect the two or more units simply in parallel.

(1) To operate three units in parallel, connect the terminals of the rear panels as shown in Figure 11. (To operate two units in parallel, eliminate the connections indicated with the dotted lines.)

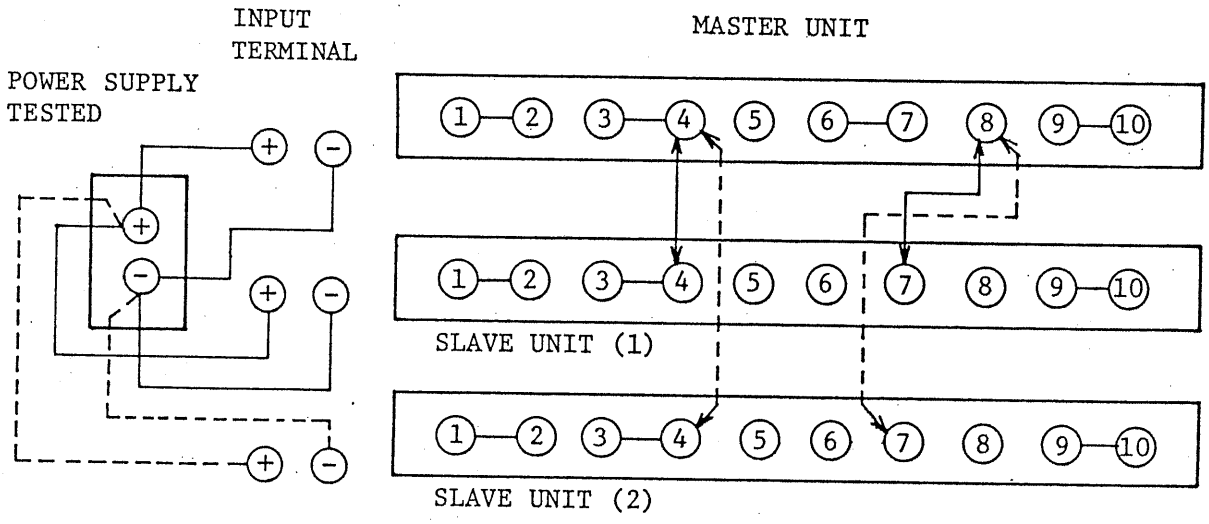



Figure 11

* Be sure to connect the lead wires to the PLZ50-50 units directly from the power source as shown in Figure 11.

(2) Turn-on the power source switch and the load switches starting by those 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 end 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 operate mutually independently.

* Connect the terminals of the rear panels with leadwires for the minimum distances.

* 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:

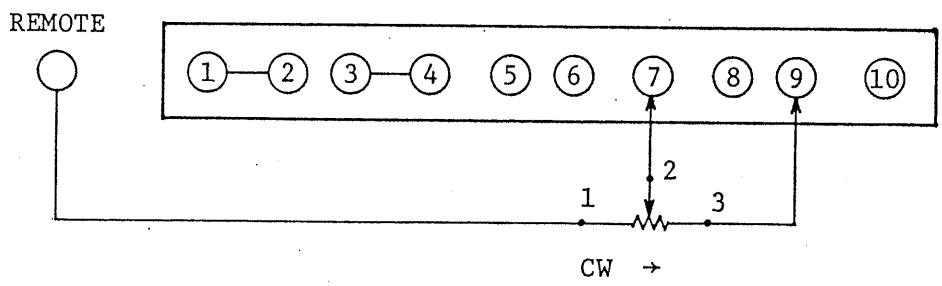



Figure 12

(1) Connect a variable resistor (1.5 kΩ) as shown in Figure 12.

(2) When the variable resistor is placed far apart from the device, use a shielded cable in order to guard against external induction noise which may cause ripples and other adverse effects.

(3) The current varies if the fine-adjustment LOAD knob (red) is varied. Keep this knob set in the maximum position.

* 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 Figure 13 so 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.

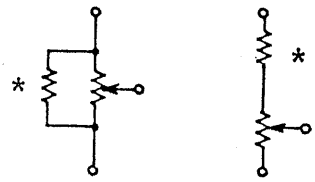



Figure 13

## 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 55 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 300-watt heat dissipation. If the power exceeds 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 Figure 14. Since the device is designed for 300 watts, operate with a power within the shaded area in Figure 14. If a larger power is required, use two or more units in parallel.

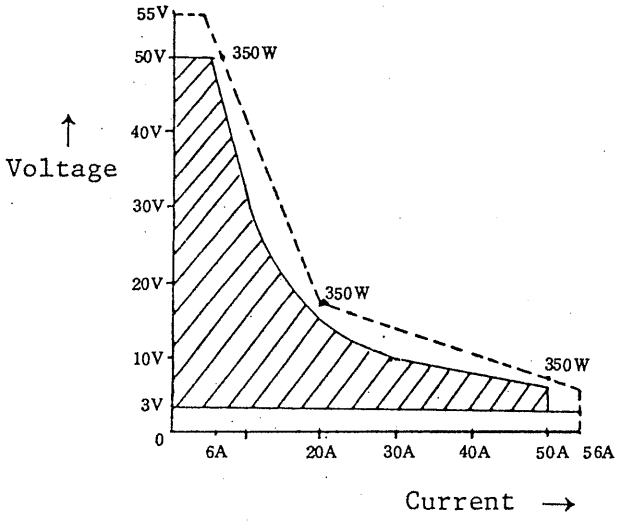



Figure 14

4.8.3 Reverse-polarity Protection Circuit

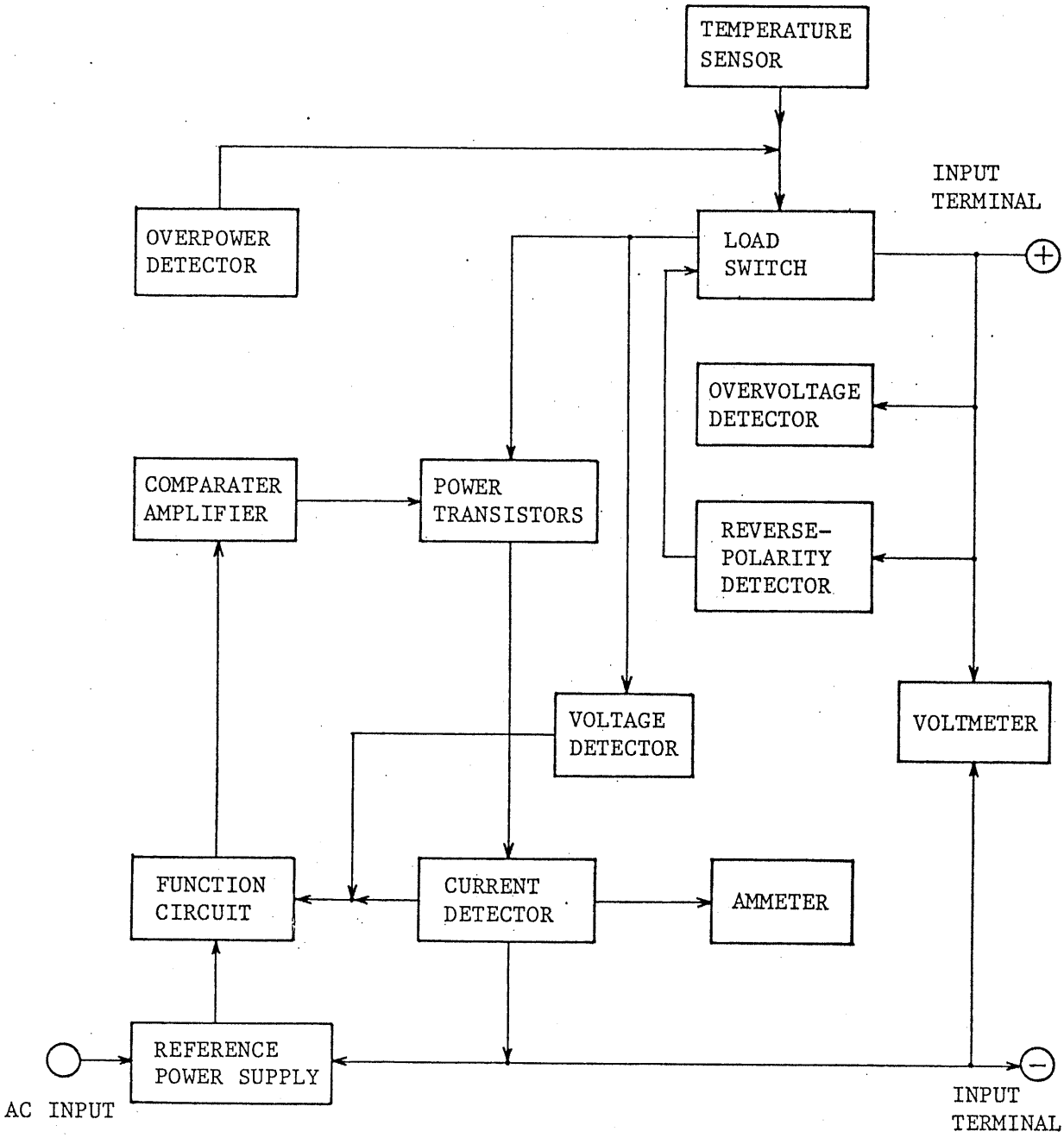
This circuit trips the load switch when the input power (with a voltage of approximately 3 V or over) is applied in the reverse polarity.

Precaution: Be especially careful regarding the polarity when a large power source which is capable of feeding 60 A or over at 30 V is connected to this device because such source can damage this device.

4.8.4 Overheat Protection Circuit

Even when the device is operated within its ratings, the internal temperature of the device may become untolerably high due to imperfect ventilation as mentioned in Item 4.1 (2). This circuit causes the load switch to trip when the internal temperature of the device has risen above the tolerable limit. The device can be restarted 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 Item 4.8.4, cool off the device and, then, turn-on the switch. Unless the device has been cooled off, the switch may trip again at the instant it is turned on.




Block diagram of PLZ50-50 Electronic Load