MODEL PAC 70 -1.5

REGULATED DC POWER SUPPLY

OPERATION MANUAL

KIKUSUI ELECTRONICS CORP.

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

Blue (NEUTRAL)
Brown (LIVE)
Green/Yellow (GND)

☐ Without a power plug

White (NEUTRAL)
Black (LIVE)
Green or Green/Yellow (GND)

☐ 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 _____

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C O N T E N T S

1. INTRODUCTION

Kikusui Electronics' Model PAC 70-1.5 is an all-silicon-transistorized.

highly reliable, variable regulated DC power supply which has excellent

regulation, a low temperature coefficient and quick transient response.

It is a universal type usable for either a digital or analog circuit.

The output voltage is adjustable finely and automatically over a range

of zero to 70 V with a 10-turn r type variable resistor.

The maximum output current is 1.5A. Model PAC 70-1.5 can be used as a

constant current power supply over a range of 0.1 to 1.5A.

Use of a new circuit technique (utility model patent pending) permits

the constant current characteristics to be improved largely. as compared

with the conventional type.

Model PAC 70-1.5 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 L.E.D. mounted on the front panel indicate the respective operation

modes alternately (constant voltage or constant current).

Model PAC 70-1.5 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	........V AC ± 10%, 50/60 Hz
Full load	Approximately 240VA
Dimensions	Case 210W × 140H × 310D mm*
Maximum	215W × 165H × 353D mm
Weight	Approximately 9 kg.
Ambient temperature	0 ~ 40°C
Accessories supplied	Short bar 1
	Fast blow fuse____A 2
	Operation manual 1

Output

Terminals	Color coded, aligned horizontally. Spaced 19 mm equally (−, GND, +); 5 terminals on the rear panel (−sampling, −, GND, +sampling, +); a built-in switch for output.
Polarity	Positive or negative
Floating voltage	±300V maximum

Constant voltage characteristics:

Voltage	0 ~ 70 V continuously variable with 10-turn variable resistor.

Current	1.5A
Ripple	500 µV rms
Voltage regulation	
Line regulation	0.005% + 1mV against ±10% variation of line voltage
Load regulation	0.005% + 1mV against 0 ~ 100% variation of load current
Constant current characteristics:	
Voltage	0 ~ 70 V continuously variable with 10-turn variable resistor
Current	0.05~1.5 A
Ripple	0.5mA rms
Current regulation	
Line regulation	0.5mA against ± 10% variation of line voltage
Load regulation	2mA against 0 ~ 100% variation of output voltage
Transient response time	Typical value 100 µs
Temperature coefficient	Typical value 100 PPM/°C
Operation	Series operation
	Parallel operation
	One-control parallel operation
	Output voltage remote control

Operation mode indication

    L.E.D. indication   Constant voltage .... C.V

                                 Constant current .... C.C

Voltmeter   DC 70 V   accuracy ...... 2.5% of full scale

Ammeter   DC 2 A   accuracy ...... 2.5% of full scale

* Two PAC 70-1.5 can be mounted side by side on a 19" or 500 mm standard rack with the rack mount frame.

3. OPERATION (1)

3.1 Explanation of Panel (See Fig. 1.)

(1) POWER switch

ON/OFF switch for the input power.
Throw it upwards, and the power is on.

(2) Pilot L.E.D.

Lights when the power is on.
red

(3) Constant voltage indicating L.E.D.

Lights when Model PAC 70-1.5 in the constant voltage mode; red

(4) Constant current indicating L.E.D

Lights when Model PAC 70-1.5 is in the constant current mode; red

(5) OUTPUT

ON/OFF switch for the output.
It can disconnect the output from the load.

(6) VOLTAGE

Knob for setting the output voltage.
Clockwise rotation increases the output voltage.

(7) CURRENT

Knob for setting the output current.
Clockwise rotation increases the output current.

(8) Voltmeter

Reads the output voltage. DC 70 V.
Accuracy is 2.5% of the full scale.

(9) Ammeter

Reads the output current. DC 2 A.
Accuracy is 2.5% of the full scale.

(10) Output terminal

Spaced 19 mm equally and aligned in the following order; from the left, -(white), GND(black), +(red).

3.2   Explanation of Rear Panel (See Fig. 2.)

(11) Input fuse   Inserted in the primary of the power
                                        transformer to avoid possible sub-
                                        sequent faults during a Model PAC
                                        trouble.
                                        Time lag type _____A.

(12) Output fuse   Inserted on the output side to prevent
                                        surge current during a Model PAC 70-1.5
                                        trouble from flowing through the
                                        equipment connected, and from causing
                                        resultant damage. _____A Fuse.

(13) Rear terminal plate   Output terminals, sampling terminals,
                                        remote control terminals and one-
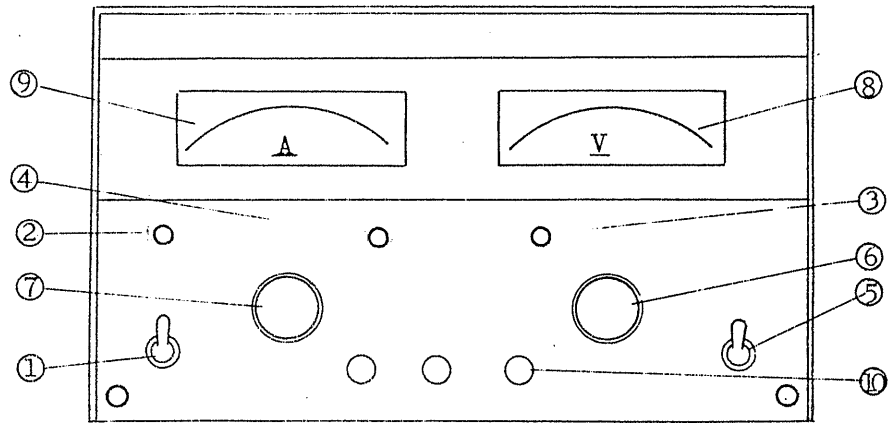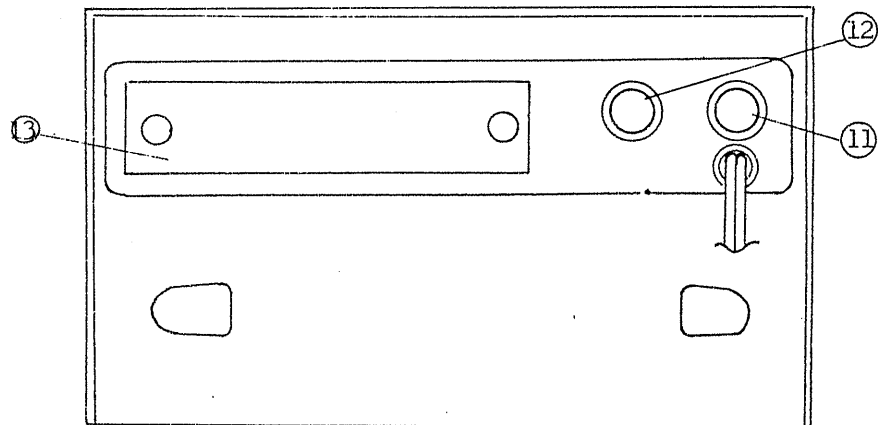   control parallel operation terminals
                                        are provided on it.

Fig. 1   Front Panel

Fig. 2   Rear Panel

3.3   Precaution

AC input

AC input for Model PAC 70-1.5 should be within a range of

.......V AC ± 10%, 48 ~ 62 Hz.

Installation

Avoid using Model PAC 70-1.5 at a place exposed to heat: where

the ambient temperature exceeds a range of zero to 40°C; that

is humid or dusty; where it won't be level.

During operation, don't lay Model PAC 70-1.5 on its side nor

put anything on it. Otherwise. a fault may be caused by reduction

of its radiation effect.

3.4   How to Use Sampling Terminals

When Model PAC 70-1.5 is positioned 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 on the rear panel serve to solve this trouble.

For the connection diagram, see Fig. 3.

1.   Disconnect the jumpers between terminals 1 and 2, 4 and 5 on

the rear panel.

2.   Connect the output terminals on the rear or front panel with

the load. Connect the sampling terminals and the nearest load

terminals with other leads.

Match the polarity of the sampling terminals to that of the
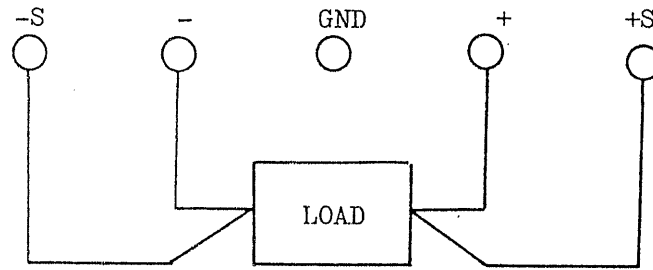
output terminals.

Fig. 3

Note 1   Deterioration of load regulation is calculated by

the following formula;

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

where

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

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 careful since the lead connected to the load affects

the preset constant current value due to its resistance.

4. OPERATION (2)

4.1   Single Operation

Constant voltage performance

1. Connect the power cord. Throw the power switch upwards, and Model PAC 70-1.5 is energized immediately, lighting the pilot lamp simultaneously.

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

3. Throw the output switch downwards. Connect the output terminals and the load.

4. Throw the power switch upwards, and the output is connected to the load.

   Note: When requiring limiting the load current to a certain value, throw the power switch upwards after the procedure described in Paragraph (2) above. Short the output terminals. Set "CURRENT" knob to the desired current value.

Constant current performance

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

2. Turn "VOLTAGE" knob clockwise until stop.
             (This implies the maximum output voltage.)

3. Throw the output switch upwards. Short the output terminals.
    Turn "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.

5. The same as Paragraph 4 in "Constant voltage performance"
    above.

   Note 1   Model PAC 70-1.5 is a constant voltage-current automatic
            crossover type. When the load current is large, the
            constant current mode is changed over to the constant
            voltage mode at a specific voltage.
            Thus, when requiring to limit the output voltage to a
            certain value, preset the output voltage to the desired
            value.

   Note 2   The constant voltage or constant current mode is indicated
            by the respective L.E.D. on the front panel alternately.
            Constant current mode lamp .... C.C
            Constnat voltage mode lamp .... C.V

   Note 3   For use of the sampling terminals, see Note 3 in
            Chapter 3.4 "How to use sampling terminals".

4.2   Series Operation

A higher output voltage than 70V can be obtained by connecting

two Model PAC70-1.5s in series.

Note 1   Be careful not to ground the positive terminal of

                one Model PAC 70-1.5 when grounding the negative

                terminal of the other in Fig. 4.

Note 2   The voltage at each output terminal should not exceed
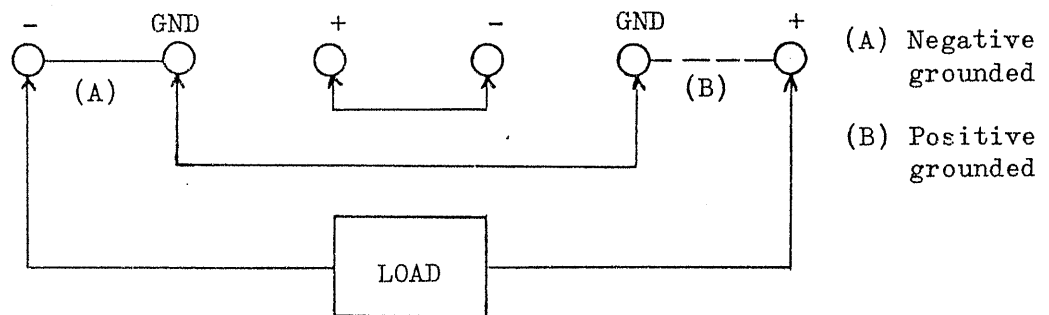
                the floating voltage.

Fig. 4   Series operation connection diagram

When two Model PAC70-1.5s connected in series are overloaded,

one Model PAC 70-1.5 , which has been changed over to the constant

current mode first, would be supplied with the output voltage of

the other inversely.

This would damage a series transistor of the former.

To avoid this trouble, a diode is connected between the output

terminals of each Model PAC70-1.5, as shown in Fig. 5.
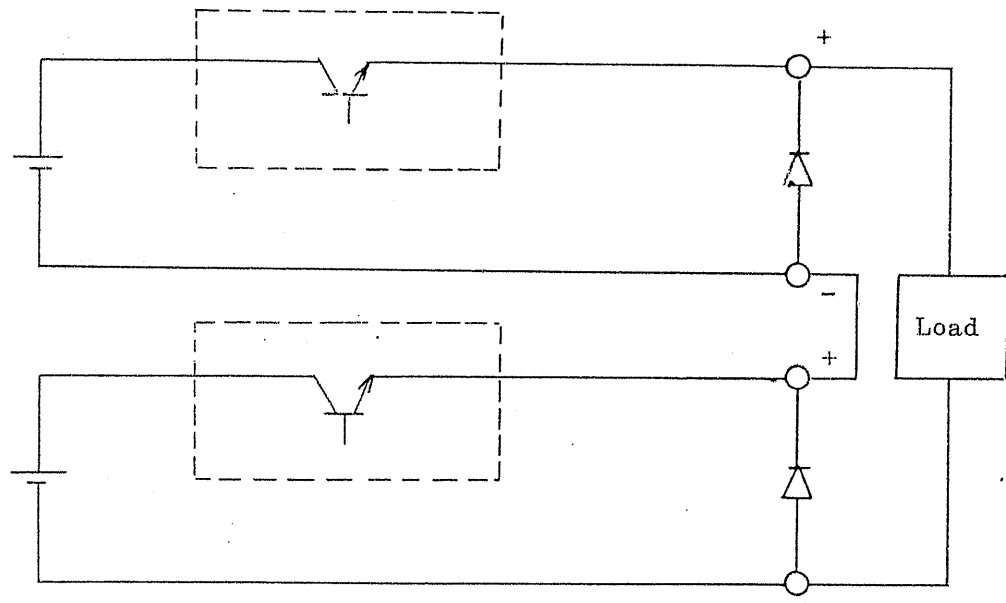
Patent pending No. 308280.

Fig. 5

4.3 Parallel Operation

When a larger current than1.5 A is required, connect the output terminals of two Model PAC70-1.5s in parallel.

1. Set the output voltages of the two Model PAC70-1.5s in parallel operation at values as close to each other as possible, since a setting difference between the two would cause load fluctuation.

2. Turn "CURRENT" knobs fully clockwise.

3. Connect the output terminals of two Model PAC70-1.5s to the load so that their polarity matches.
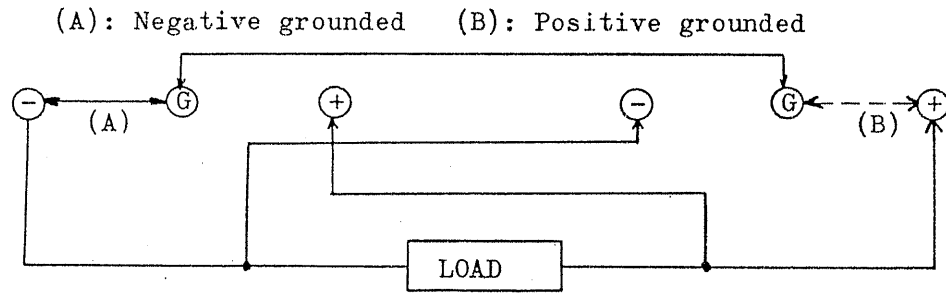The grounding polarity of both should also match.

(A): Negative grounded   (B): Positive grounded

Fig. 6 Parallel operation connection diagram

Voltage-current characteristics in parallel operation

As the voltage-current characteristics in parallel operation in

Fig. 7 show the output voltage in parallel operation remains

constant until one Model PAC 70-1.5 with a higher output voltage

is overloaded. When one Model PAC 70-1.5 is changed over to the

constant current mode, the output voltage decreases until it

reaches the value preset by the other Model PAC 70-1.5, whose

output terminals are changed over from an inverse voltage condition

to a normal one, causing the constant voltage mode. Thus, load

fluctuation causes the output voltage to fluctuate by the preset

output voltage difference Δ V between the two units, and ripple
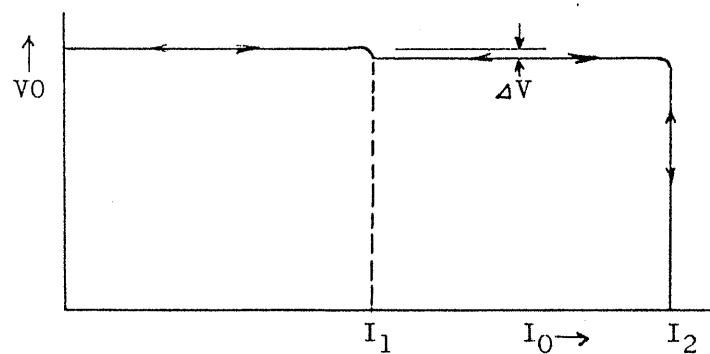
characteristics are reduced.

Fig. 7 Characteristics diagram

4.4   One-control Parallel Operation

When a larger current than 1.5 A is required, one-control parallel

operation of two Model PAC 70-1.5 S is preferable since the charac-

teristics are improved largely, as compared with those in parallel

operation.

In one-control parallel operation, one of the Model PAC 70-1.5s

operates as the master unit, by which the output voltage is adjusted,

and the other as the slave whose output voltage is controlled by the

master unit.

1.   Connect the terminals on the rear panel of the master or

     slave and the load as shown in Fig. 8.

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   Picking up the output on the output on the front panel

               of the master causes load regulation to be deteriorated

               somewhat, and current unbalance occurs between the

               master and slave.

     Note 2   To prevent load regulation from deteriorating, use the

               sampling terminals.

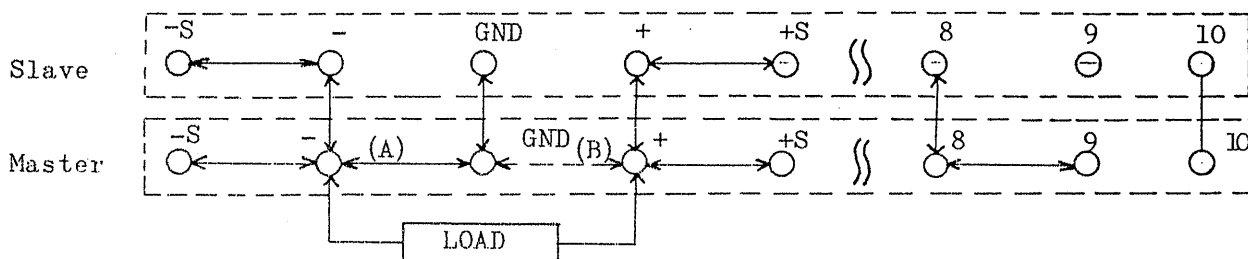   Note 3   Turn "VOLTAGE, CURRENT" knobs of the slave fully

               clockwise.

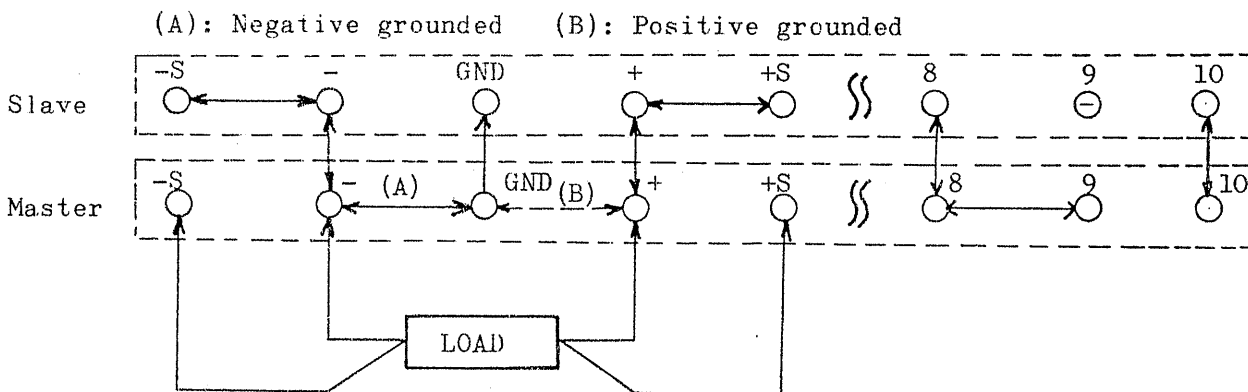Fig. 8   One-control parallel operation master,
         slave, load

(A): Negative grounded   (B): Positive grounded

Fig. 9   Using sampling terminals in one-control
         parallel operation

4.5   Remote Control

When remote control of the output voltage setting or improvement

of its resolution in Model PAC 70-1.5 is required, use the

terminals for remote control.

Turn off the power switch. Connect the terminals on the rear

panel, the load and the external variable resistor as shown in

Fig. 10.

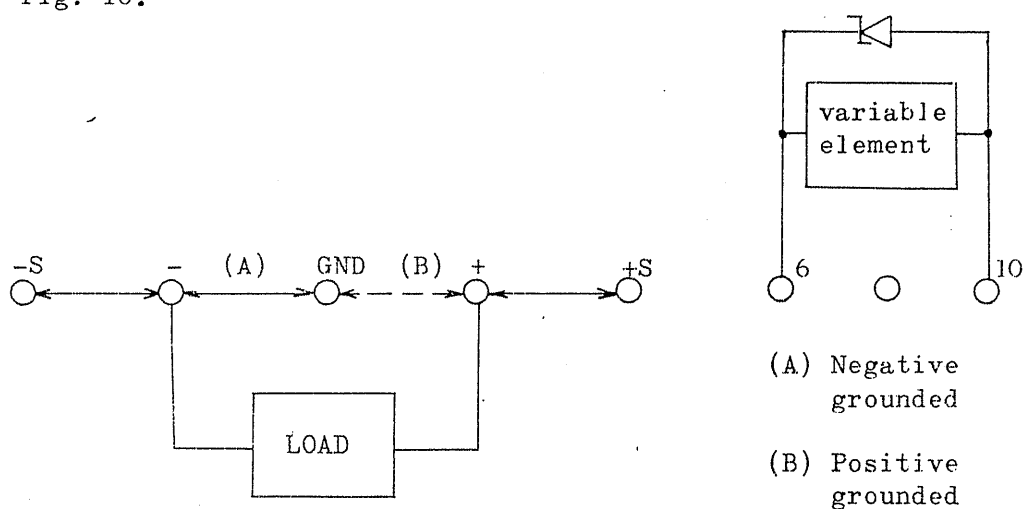(A) Negative
    grounded

(B) Positive
    grounded

Fig. 10   Remote control connection diagram

Turn ON the power switch, and the output voltage can be adjusted

with the variable resistor in steps of approx. $\dfrac{V_{ref}}{\frac{0.7}{K\Omega}}$ $\left[K\Omega\right]$

When a voltage higher than a certain value is not desired,

connect a zener diode (with a small leakage current) in parallel

with the variable resistor.

A wire-wound variable resistor or a metal film variable resistor

whose temperature coefficient is small, rated wattage is more

than 0.5W, and whose resistance value is not more than 10 KΩ is

recommended. Use two-conductor shielded wire for connecting

the variable resistor and Model PAC 70-1.5

5. MAINTENANCE

5.1   Adjustment of Maximum Output Voltage

1) Turn VOLTAGE knob to clockwise *fully*.

2) Turn on OUTPUT switch, and connect a voltmeter having an accuracy of over 0.5% to the output terminal.

3) Adjust semi-fixed resistor R9 on PCB A-001A until the output voltage becomes 72 V.

5.2   Adjustment of Maximum Output Current

1) Turn VOLTAGE knob fully counter clockwise.

2) Turn CURRENT knob fully clockwise.

3) Connect an ammeter having an accuracy of over 0.5% to the output terminals, and slowly increases the voltage by turning VOLTAGE knob.

4) Turn semi-fixed resistor R14 on PCB A-001A until the output current becomes 1.6 A.

5.3   Adjustment of Relay Switching Voltage

1) Set the output voltage to 38 V.

2) Turn semi-fixed resistor R13 on PCB A-006 fully clockwise, and then turn it counter clockwise slowly until the relay is switched.
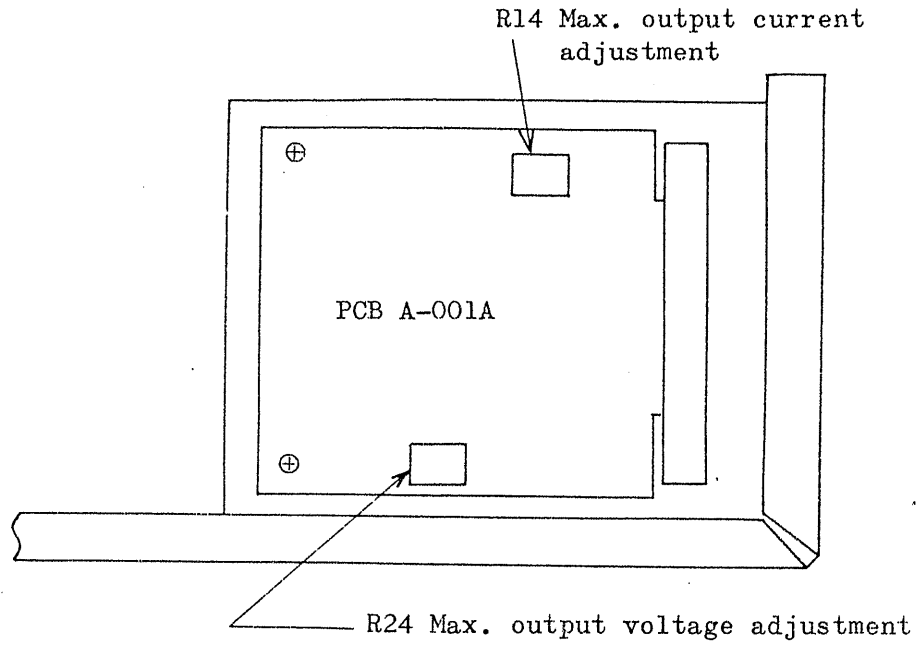
R14 Max. output current
adjustment

PCB A-001A

R24 Max. output voltage adjustment
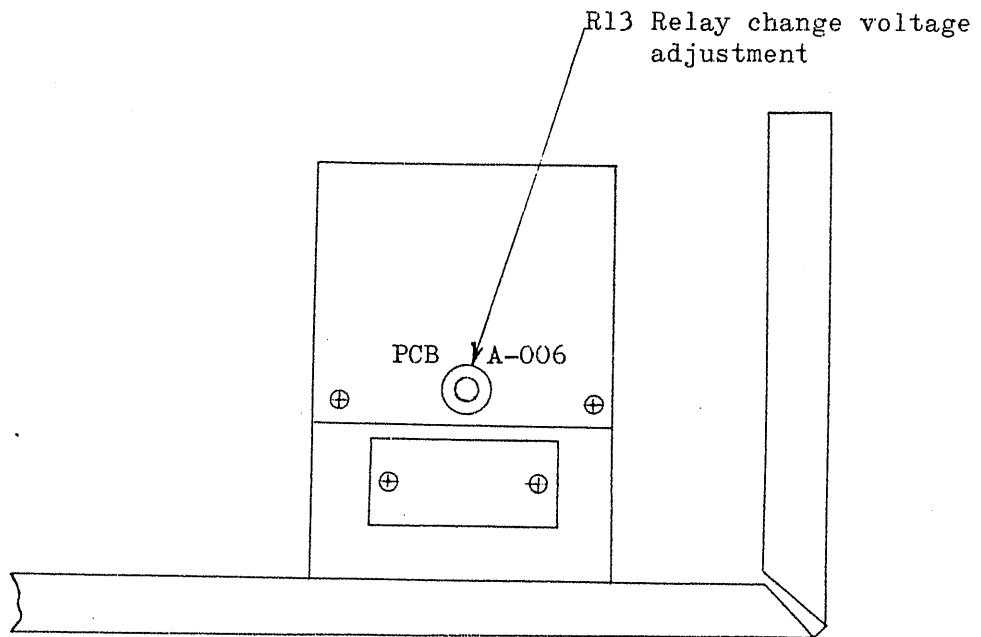
Fig. 5-1   Right side PCB A-001A

R13 Relay change voltage
adjustment

PCB   A-006

Fig. 5-2   Left side PCB A-006