INSTRUCTION MANUAL

FOR

DC OVERVOLTAGE PROTECTOR

MODEL OVP L

APPLICABLE MODELS

OVP16-50L

OVP35-30L

OVP55-20L

OVP110-10L

OVP250-10L

KIKUSUI ELECTRONICS CORPORATION

On Power Supply Source, it is requested to replace the related places in the instruction manual with the following items.

(Please apply the item of ☐ mark.)

☐ Power Supply Voltage: to _ _ _ _ _ V AC

☐ Line Fuse: to _ _ _ _ _ A

☐ Power Cable: to 3-core cable (See Fig. 1 for the colors.)

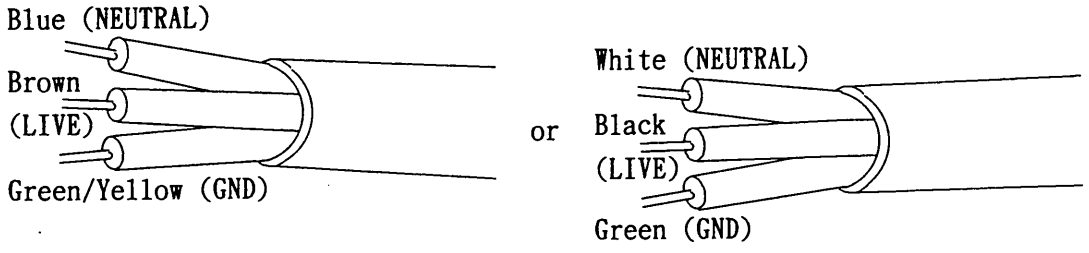

Fig. 1

Please be advised beforehand that the above matter may cause some alteration against explanation or circuit diagram in the instruction manual.

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* AC Plug: In case of Line Voltage 125V AC or more, AC Plug is in principle taken off and delivered, in view of the safety.
(AC Plug on 3-core cable is taken off in regardless of input voltages.)
TO connect the AC plug to the AC power cord, connect the respective pins of the AC plug to the respective core-wires (LIVE, NEUTRAL, and GND) of the AC power cord by referring to the color codes shown in Fig. 1.

Before using the instrument, it is requested to fix a suitable plug for the voltage used.

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1. GENERAL

1.1 Introduction

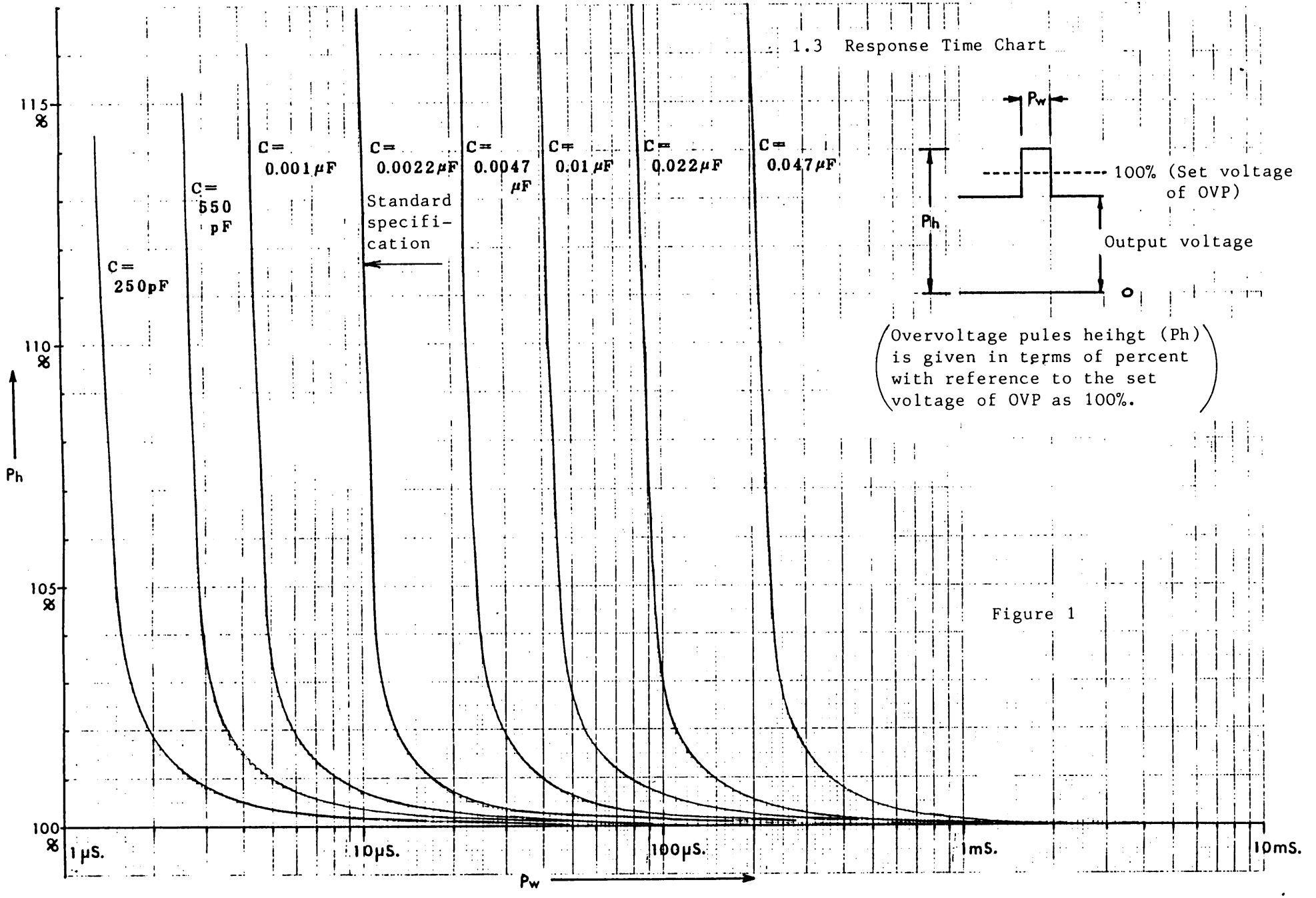
Models OVP16-50L, OVP35-30L, OVP55-20L, OVP110-10L and OVP250-10L DC Overvoltage Protectors have been designed specifically for use with the PAD-L Series Power Supplies, to protect the load against overvoltages which could be caused by malfunction of the power supply, erroneous handling, or external noise. While the response time is 10 microseconds at standard, it is adjustable for a range of several microseconds to several hundreds microseconds to best suit the type of load and the conditions of use, relieving you from being annoyed by too rapid or sluggish response of a protector.

1.2 Specifications

Name	DC Overvoltage Protector				
Model	OVP16-50L	OVP35-30L	OVP55-20L	OVP110-10L	OVP250-10L
Voltage setting Range	4V - 18V	4V - 38V	6V - 61V	11V - 120V	25V - 280V
Temperature Coefficient of Voltage Setting	50 ppm/°C (typical)				
Response Time*	10 μs standard. Adjustable (See Figure 1.)				
Protective Actions	Shutdown of PAD-L output with thyristor and turning off of power switch				
Ambient Temperature	0 to 40°C (32 to 104°F)				
Insulation Resistance	20 MΩ or more, between chassis and output terminals, with 500 VDC				
Dimensions	61 W × 116 H × 360 D mm (2.40 W × 4.56 H × 14.17 D in.) (See Figure 2.)				
Weight	Approx. 470 g	Approx. 430 g	Approx. 380 g	Approx. 360 g	Approx. 360 g
Supply Voltage	12.6 V ±10%, 50/60 Hz AC				
Power Consumption	Approx. 0.4 VA				
Applicable Power Supplies	PAD16-30L PAD16-50L	PAD35-15L PAD35-20L PAD35-30L	PAD55-10L PAD55-20L	PAD110-5L PAD110-10L	PAD160-7L PAD160-3.5L PAD250-4.5L
Accessories	Two brackets (1), Two brackets (2), Two M4-10L spacers. (See Figures 3 and 4.)				

* Response Time: In terms of width of pulse whose voltage exceeds the set voltage of OVP. (See Figure 1.)

1.3 Response Time Chart



(Overvoltage pules heihgt (Ph) is given in terms of percent with reference to the set voltage of OVP as 100%.)

Figure 1

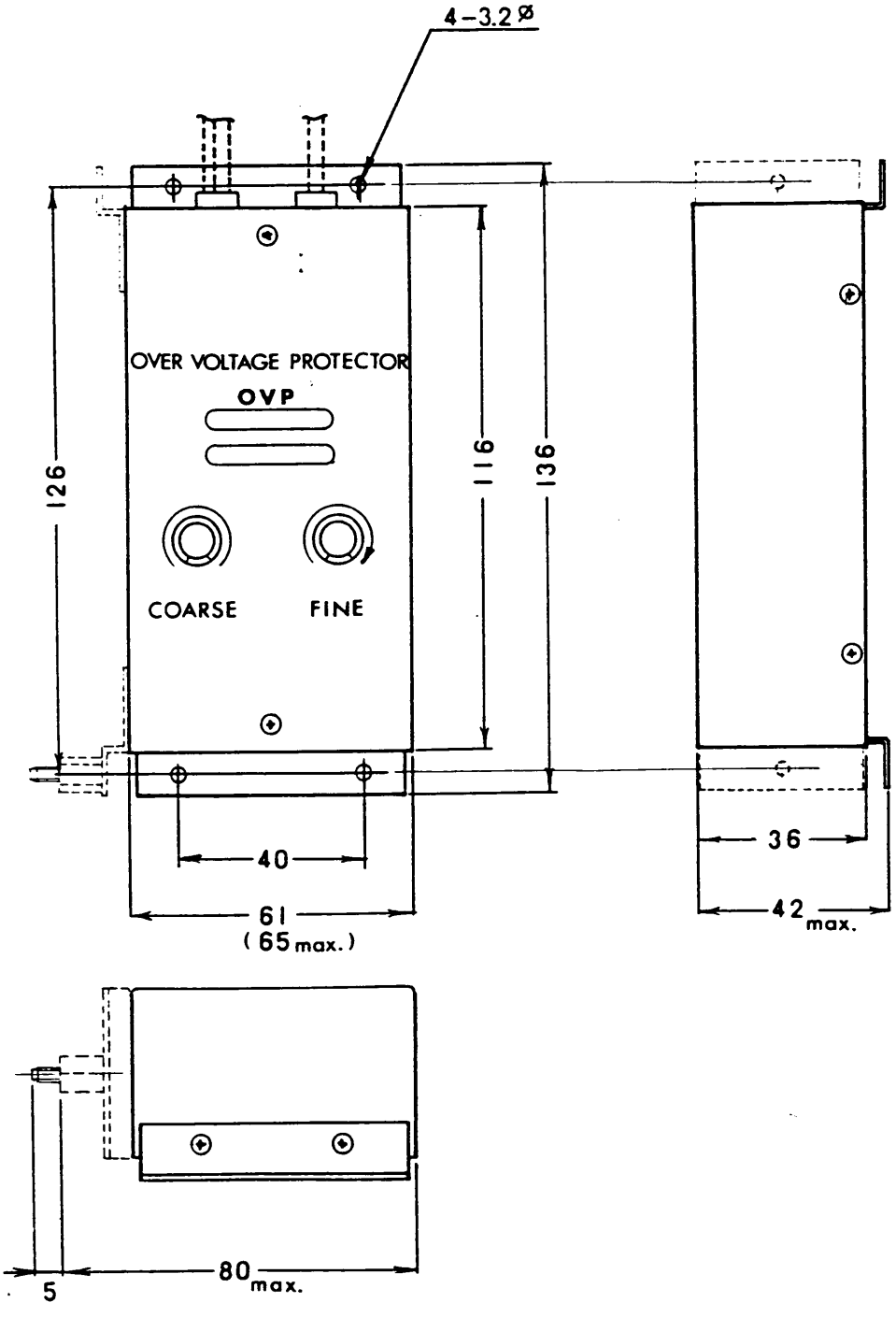


Figure 2. Overall Dimensions of the OVP

2. OPERATION METHOD

2.1 Installation Procedure (1)

Applicable Models:

PAD16-30L
PAD35-15L
PAD35-20L
PAD55-10L
PAD110-5L
PAD160-3.5L

Warning: Be sure to turn off the power switch before installing the OVP.

To install the OVP on a PAD-L, proceed as follows referring to Figure 3.

(1) Fix the brackets (1) to the OVP.

(2) Fix the M4-10L spacers to the rear of the PAD-L and install the OVP with the spacers and brackets.

(3) Remove the cover of the PAD-L.

(4) Cut away the solderless crimping terminals of the wires (7), (8), (9) and (10). Pass the wires into the PAD-L through the hole for wiring for the OVP, and solder the wires to printed circuit board A-95.

(5) Connect securely the red wire to the "+" terminal at the rear of the PAD-L and the white wire to the "-" terminal.

Mounting parts: Bracket (1) x 2
M4-10L Spacer x 2

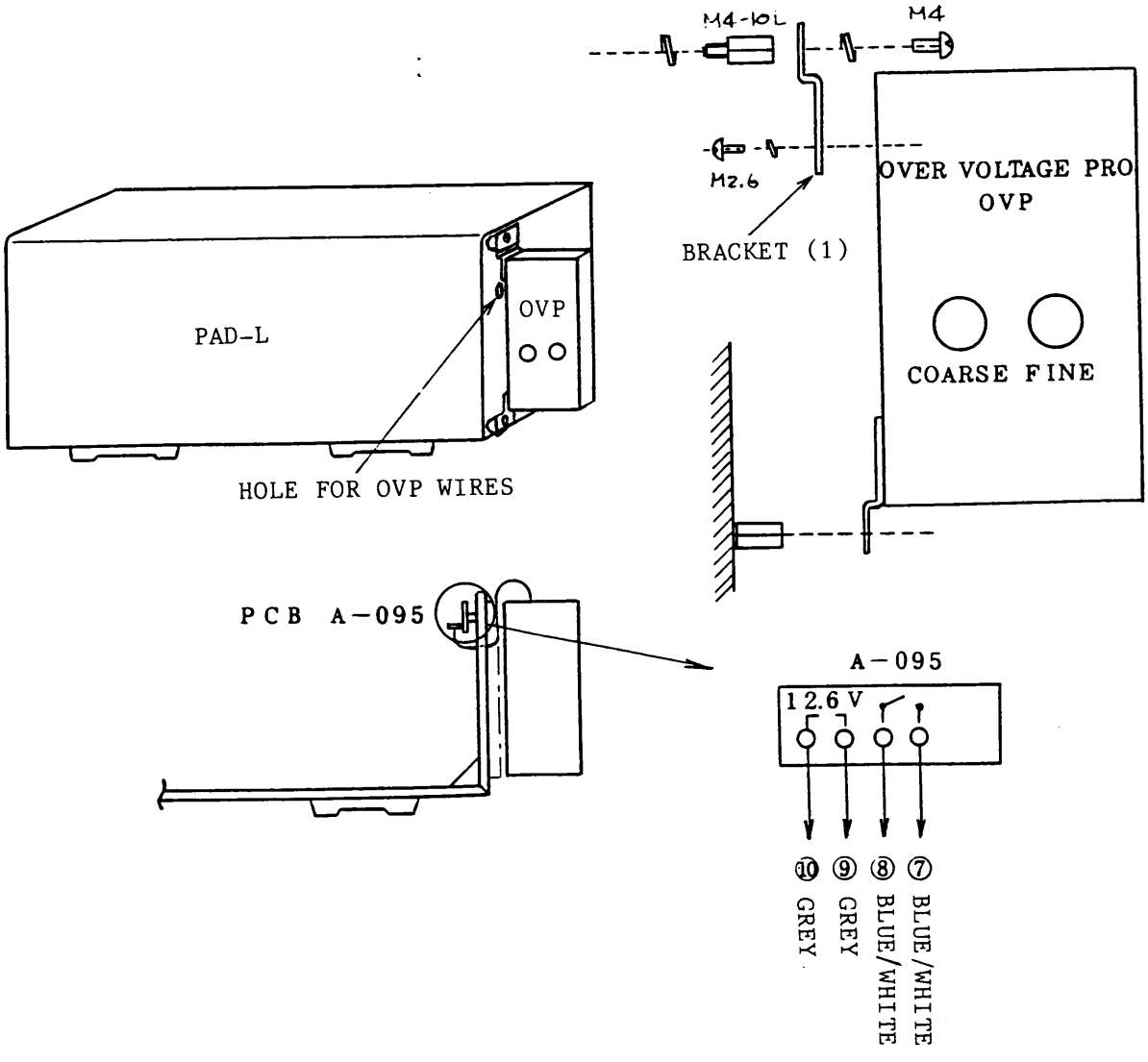


Figure 3

Installation Procedure (2)

Applicable Models:

PAD16-50L
PAD35-30L
PAD55-20L
PAD110-10L
PAD160-7L
PAD250-4.5L

Warning: Be sure to turn off the power switch before installing the OVP.

To install the OVP on a PAD-L, proceed as follows referring to Figure 4.

(1) Fix the bracket (2) to the OVP.

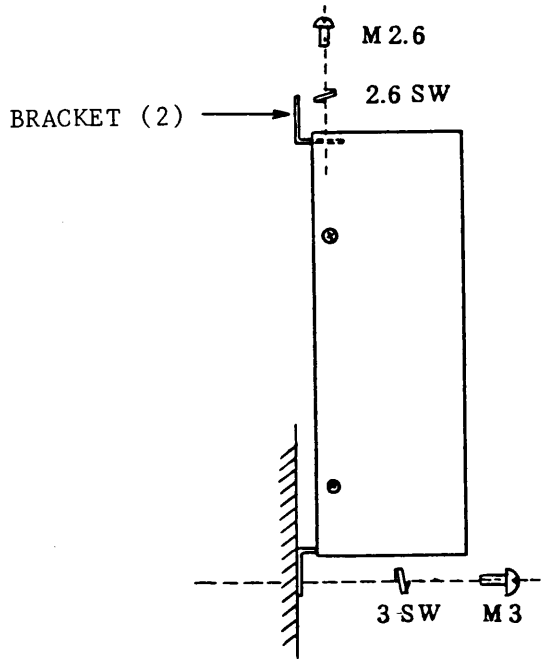
(2) Install the OVP on the rear of the PAD-L.

(3) Connect the wires (7), (8), (9) and (10) of the OVP to the rear terminals of the same numbers of the PAD-L. (See Note 1.)

(4) Connect securely the red wire to the "+" terminal at the rear of the PAD-L and the white wire to the "-" terminal.

Note 1: If no " AC " mark is indicated between rear terminal (9) and (10) of the PAD-L, check that 12.6 VAC is being delivered to between terminals (9) and (10). Of the PAD-L power supplies manufactured on early dates, locations of terminals (7) and (8) and terminals (9) and (10) are in the reverse of those shown in Figure 4.

Mounting Parts: Brocket (2) x 2



CLOLRS OF OVP WIRES

⑦ – BLUE/WHITE

⑧ – BLUE/WHITE

⑨ – GREY

⑩ – GREY

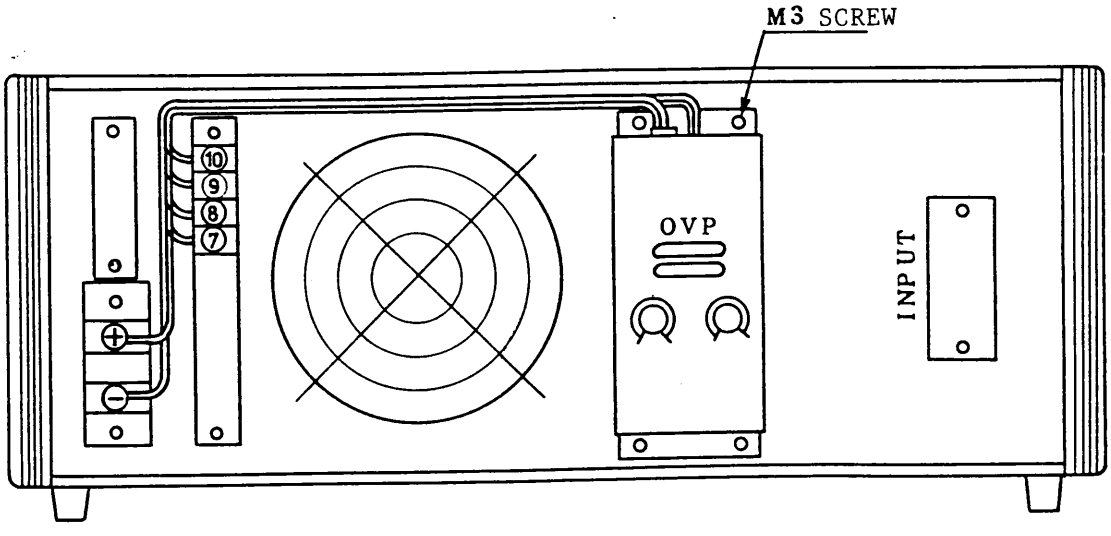


Figure 4

2.2 Precautions Before Use

(1) Do not use the OVP for a large capacitor load or a battery load unless connections have been properly modified.

The OVP protects the load by triggering the thyristor which is connected between the output terminals as shown in Figure 5. If the load is a large capacitor or a battery, it is possible that a very large discharge current flows through the thyristor, thereby damaging it instantaneously. For these types of loads, the cathode of the thyristor must be connected to that of the reverse-current protective diode※ provided in the PAD-L, so that the reverse current from the load is checked and the OVP absorbs the abnormal current of the PAD-L side alone to protect the load. For this connection modification, please order your Kikusui agent.

*: The PAD16-50L has no reverse-current check diode. An additional protective diode is needed for the above modification.

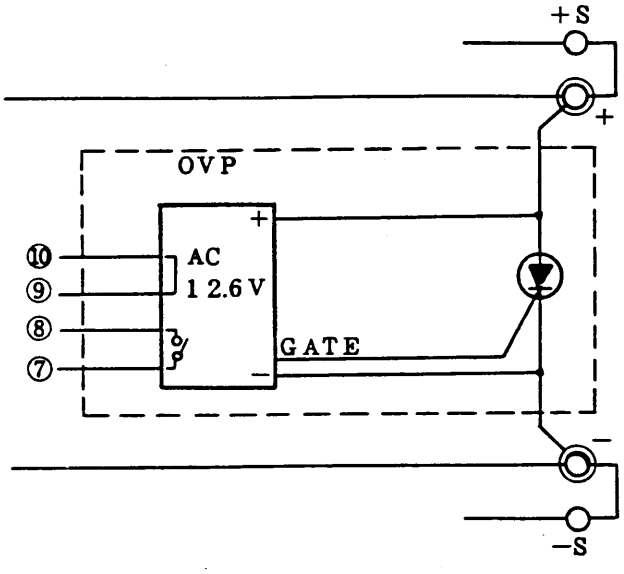


Figure 5. Connection Diagram

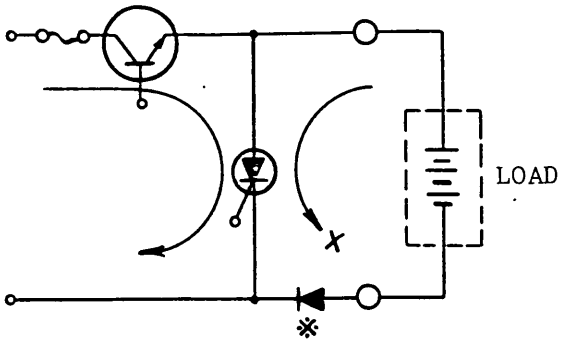


Figure 6. Connection Modification for a Capacitor or Battery Load

(2) Be sure to connect wires (7) and (8) which run from the OVP. These wires are for the contact signal to cut out the input switch. The thyristor provided in the OVP is on condition that the input switch is cut out at the instant the protective system has tripped. Note that the thyristor may be burned if the input switch is not cut out.

2.3 To Set the Trip Voltage

To set the trip voltage of the OVP, proceed as follows:

(1) Before turning on the power switch of the PAD-L, turn fully clockwise the COARSE and FINE controls of the OVP.

(2) Turn on the power switch and set the output voltage of the PAD-L at the desired trip voltage of the OVP by adjusting the output voltage control of the PAD-L.

(3) Slowly turn counterclockwise the COARSE control until the OVP trips.

(4) Slightly turn clockwise the COARSE control so that power is turned on again. Slowly turn counterclockwise to the point where the OVP trips.

Setting of the OVP trip voltage is complete by the above procedure. Lower the output voltage and then turn on the power switch.

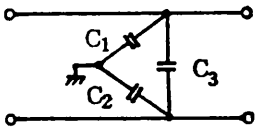
[Remarks] The voltage ranges adjustable with the FINE control are as follows:

OVP16-50L:	Approx. 0.8 V
OVP35-30L:	Approx. 1.4 V
OVP55-20L:	Approx. 2.2 V
OVP110-10L:	Approx. 4.3 V
OVP250-10L:	Approx. 13 V

Precautions:

(a) A particular attention is needed when the load is a capacitor or a battery. Refer to Section 2.2 (1).

(b) To prevent unnecessary trips of the OVP by noise introduced through the AC line, provide a noise filter as shown in Figure 7. (See Figure 10.)



Example

C1, C2: 4700pF, 3kV, ceramic

C3: 0.1μF, 600NV, polyester film

Figure 7

2.4 To Prevent Unnecessary Trips

It is possible that the OVP trips unnecessarily and unpredictably when the system is operating normally--when there is nothing wrong with the PAD-L or load and the system resumes its normal operation as you turn on the power switch again. Noise is the cause of such unnecessary trips. This is especially true when the OVP trip voltage is set very close to the PAD-L output voltage. The OVP responds to noise whose amplitude is small enough for the safety of the load but is large enough to drive the OVP.

To prevent unnecessary trips, noise should be suppressed. Major sources of noise are (1) AC line, (2) load, and (3) wiring to the load.

Another method of preventing unnecessary trips is to make the OVP less sensitive to noise by setting its response time longer within the range permissible by the load.

(1) To Suppress AC Line Noise

AC line noise is the primary cause of unnecessary trips of the OVP. Be sure to provide an AC line filter. Examples of AC line filters are shown in Figure 8. These filters suppress both normal mode noise and common mode noise.

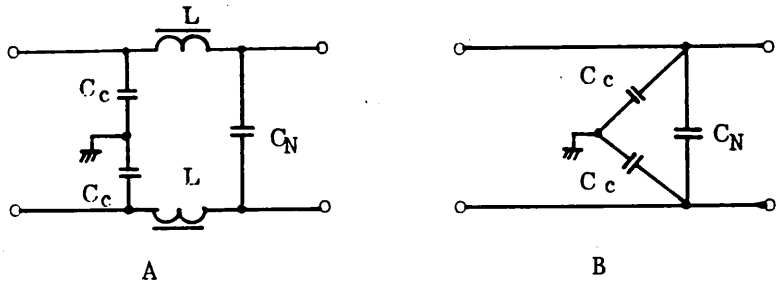


Figure 8

Filter A renders an excellent filtering effect against AC line noise. However, reactors (L) for large current are expensive. Filter B is more economical but renders a sufficient filtering effect. (See Figure 9.)

Of both filters A and B, a leak current flows to the ground due to the displacement current of capacitors C_C. When a large number of power supplies are used, a leak detector may be needed. (Normally the leak current should not be greater than 1 mA.)

Examples of filter components

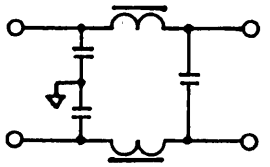
C_C: 0.0047μF, 3kV, ceramic

C_N: 0.1μF, 600V, metallized film

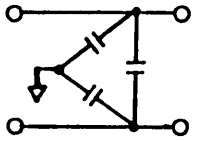
L: 50 - 100μH reactor

The below charts show the voltages at which the OVP trips when a pulse noise of rise time 1 nsec is applied to the line using a noise simulator.

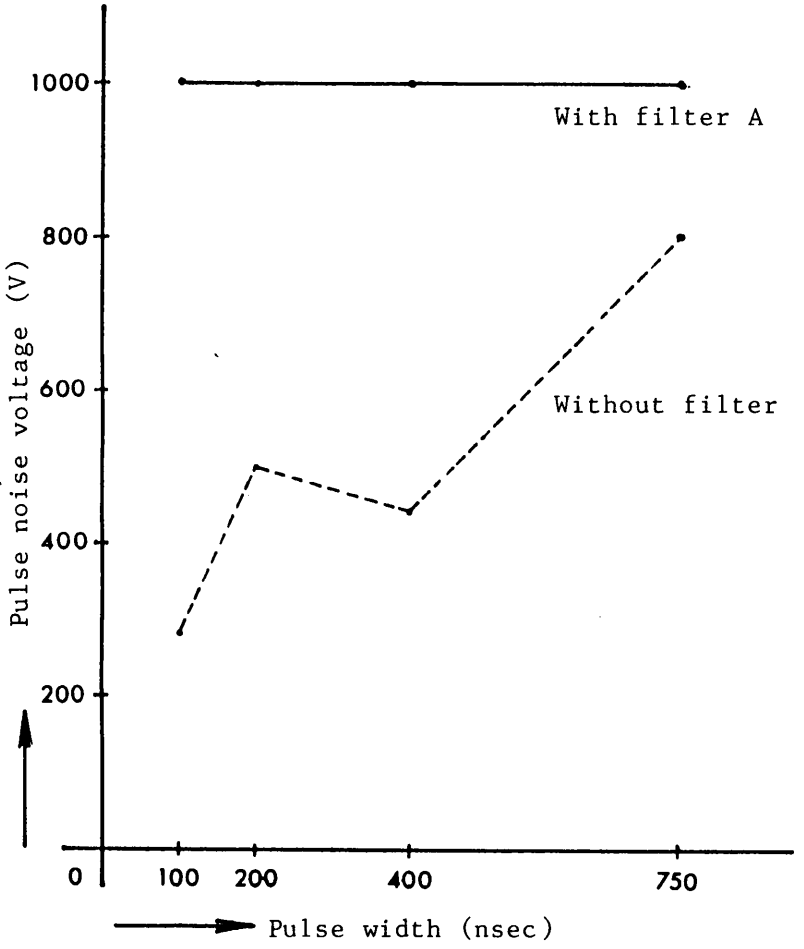
Power supply: PAD110-10L
PAD output voltage: 10 V
OVP trip voltage: 11 V



A



B



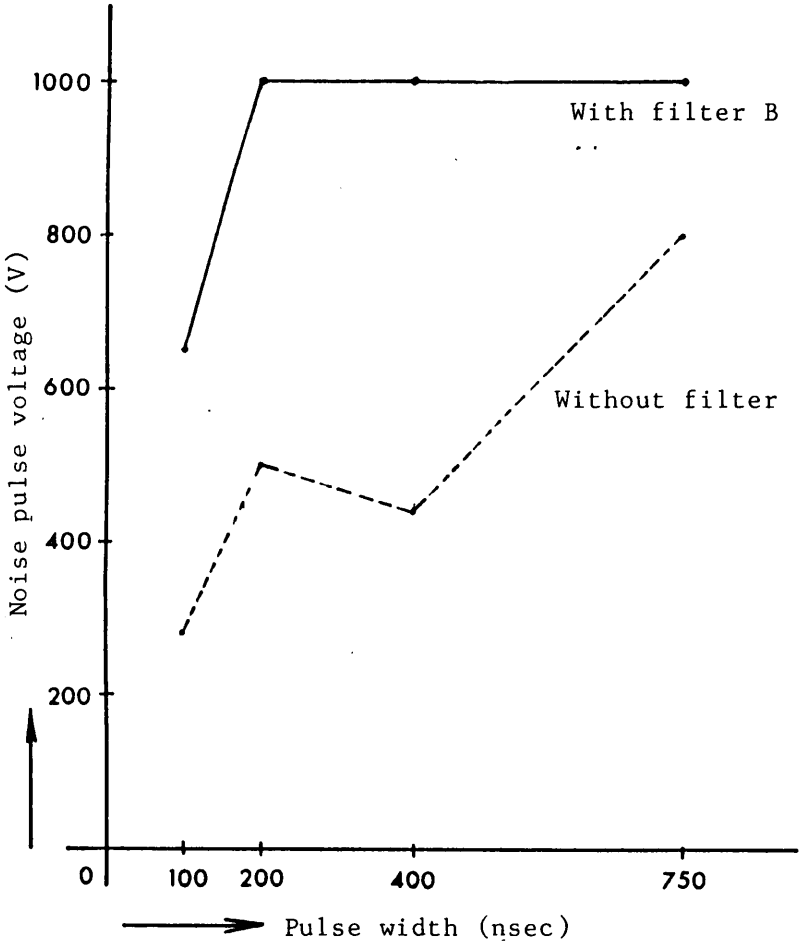


Figure 9

(2) To Suppress Noise from Load

Counterelectromotive force should be suppressed when an inductive load is switched on or off.

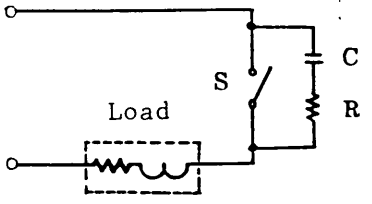


Figure 10

- o A noise killer consisting of C and R should be provided as shown in Figure 10 to suppress noise generated by switch S, especially when the output voltage is high and the switch contact is apt to be worn.

  Examples: C = 0.1μf, R = 47Ω

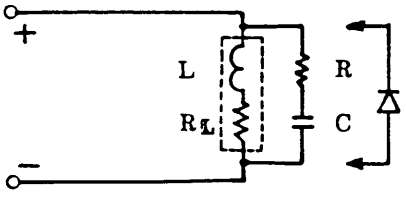


Figure 11

- o Provide a noise killer as shown in Figure 11. The constants may be $R = R_L$ and $C = R/R_L^2$.
- o A diode may be used as a commutator, although cut out of the load may become somewhat sluggish.

(3) To Suppress Noise from Wiring for Load

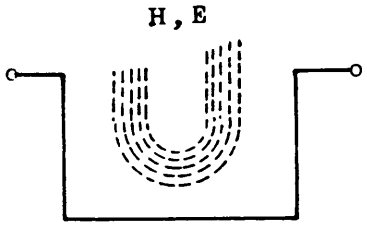


Figure 12

- o Keep the output cables for the load apart from the AC power cable and other sources of strong electromagnetic fields as shown in Figure 12.
- o Run the two output cables in close parallel as shown in Figure 13 (A) but not as shown in (B).
- o When remote sensing is employed, strand and shield the sensing wires.

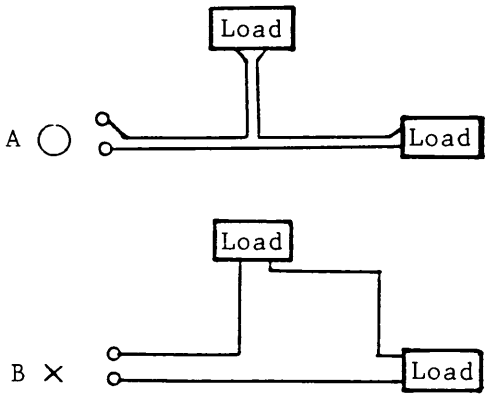


Figure 13

2.5 Changing the Response Time

The response time of the OVP can be changed by changing capacitor C403 of PCB A-064. Location of the capacitor is shown in Figure 14. The relationships between capacitance and response time are shown in Table 1. (Refer also to Figure 1.)

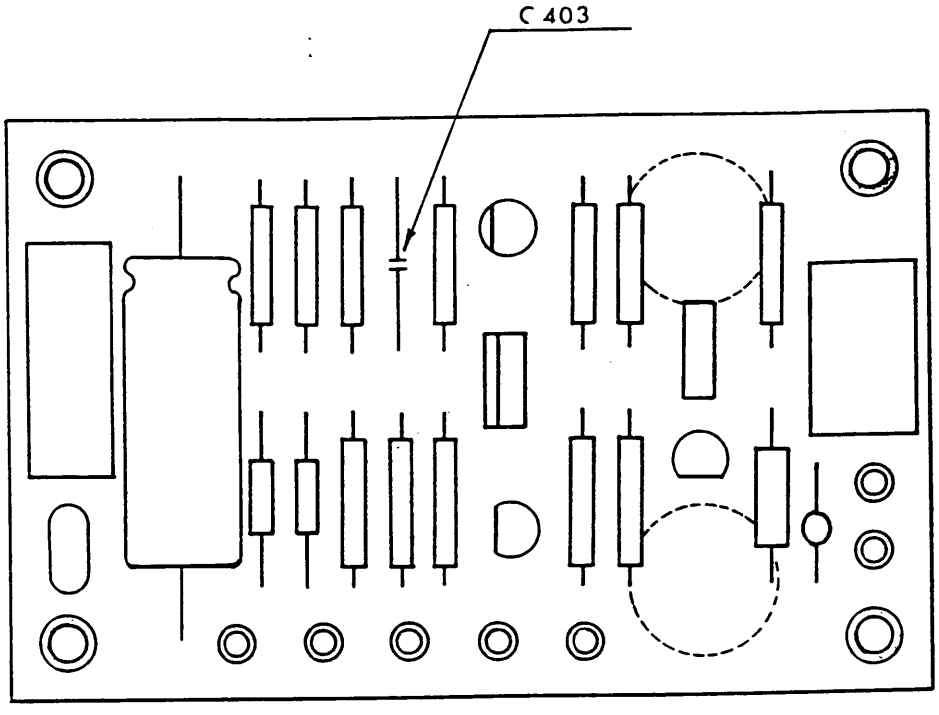
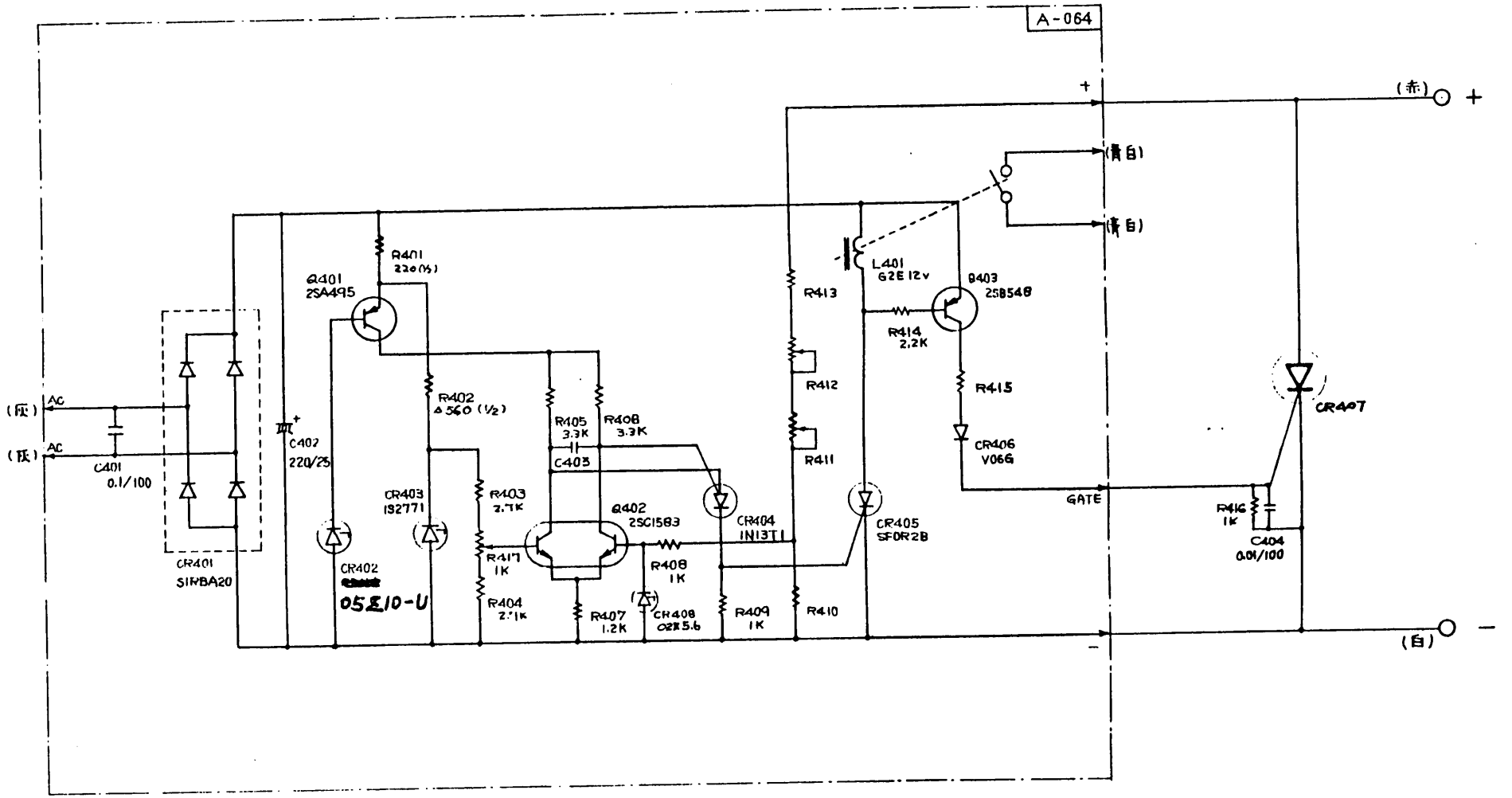


Figure 14. Location of C403 on PCB A-064

Table 1. Relationships Between Capacitance and Response Time

Response Time	Capacitance	
5 µsec	0.001 µF	50 WV or over
10 µsec	0.0022 µF	50 WV or over
40 µsec	0.01 µF	50 WV or over
90 µsec	0.022 µF	50 WV or over
200 µsec	0.047 µF	50 WV or over



	R410	R411	R412	R413	R415
16v	Δ4.2K	1K	20K	Δ330	※
35v	Δ4.7K	2K	50K	Δ620	※
55v	Δ 3K	2K	50K	Δ 2K	※
110v	Δ1.5K	2K	50K	Δ 3K	※
250v	Δ2.5K	10K	200K	Δ12K	※

NOTE

ALL RESISTOR ARE 1/4 W 5% UNLESS OTHERWISE INDICATS IN ( ).
VALUES OFF CAPACITORS ARE IN MICROFARAD/ W.V.
※ INDICATES FACTORY ADJUSTMENT.
Δ METAL FILM RESISTOR.

O.V.P. L — SERIES

CIRCUIT DIAGRAM