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OPERATOR'S MANUAL

FOR

ELECTRONIC LOAD

MODEL PLZ-72W

KIKUSUI ELECTRONICS CORPORATION

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1. GENERAL

1.1 Description

Model PLZ-72W Electronic Load is a highly versatile device which can be operated either in a constant current mode or in a constant resistance mode and is capable of handling two loading levels by electronic switching. The PLZ-72W is incorporated with automatically-resetting protectors to guard against the various types of overload. Major features of the PLZ-72W are as follows:

(1) Provided with a digital voltmeter/ammeter (3-1/2 digits).

(2) Provided with two 10-turn potentiometers to set two levels of loading current.

(3) Has a built-in oscillator for switching timing (1 mS - 100 mS) between two levels of loading current either in the constant current mode or in the constant resistance mode.

(4) When in the constant current mode, the loading current can be remote-controlled with an external voltage or resistance signal. Remote control can be done with an external resistance signal also when in the constant resistance mode.

(5) One-control parallel operation of multiple units can be done. That is, two or more unit can be connected in parallel and all of them can be simultaneously controlled simply by controlling only one of them.

(6) Provided with automatically resetting protectors to guard against overvoltage, overcurrent, overpower, overheat, and reverse-polarity connection of the input.

(7) Rack mount is possible. That is, although the PLZ-72W normally is supplied as a bench-top instrument, it can be installed on an EIA Standard rack or a JIS Standard rack by using a mounting frame and brackets which are available as options.

1.2 Specifications

Item	Specification
Model	PLZ-72W
Power requirements	
Line voltage	120 V ±10%, 50/60 Hz single-phase AC
Power consumption	Approx. 20 VA
Input	
Loading voltage	4 - 110 V DC
Loading current (resolution)	0 - 12 A (10 mA) theoretical value
Maximum loading power	70 W
Modes	
Constant current mode	0 - 12 A and 0 - 1.2 A (two ranges; continuously variable)
Constant resistance mode	0.2 Ω and 2 Ω (two ranges; continuously variable minimum 0.3 Ω)
Constant current performance	
Regulation against 4 - 110 V loading voltage change	±0.1% +2 mA (with loading current 0.5 A)
Regulation against 10% line voltage change	±0.1% +2 mA
Ripple and noise	2 mA rms (5 Hz - 1 MHz)
Temperature coefficient	0.02%/°C (typical)
Rise time, fall time	100 µS or faster (with loading current 12 A)
Constant resistance performance	
Temperature coefficient	0.02%/°C (typical)
Regulation against ±10% line voltage change	±0.1% +2 mA
Remote control	
Constant current mode	
With external voltage	0 - 10 V to control 0 - 12 A (input impedance approx. 10 kΩ)
With external resistance	0 - 5 kΩ
Constant resistance mode	
With external resistance	0 - 5 kΩ

Item	Specification
Protectors	
Overvoltage protector	Trips at approx. 115 V DC to cut out load input.
Overcurrent protector	Trips at approx. 12.5 A DC.
Overpower protector	Trips at approx. 73 W.
Reverse-polarity protector	With check diode connected in series to stop reverse current
Overheat protector	Trips at internal temperature 100°C ±5°C (212°F ±9°F) to cut out load input.
Input fuse	1 A
Digital ammeter/voltmeter	
Maximum effective display	1999
Ammeter accuracy	±(0.5% of rdg + 0.1% of FS + 1 digit) *
Voltmeter accuracy	±(0.5% of rdg + 0.1% of FS + 1 digit) *
Indication of overpower protector trip	Yellow LED (blink)
Indication of overpower or overheat protector trip	Red LED
Parallel operation	One-control operation of multiple units possible.
Current monitor output	10 mV/A (BNC terminal)
Oscillator for switching	
Switching period	1 mS - 10 mS range and 10 mS - 100 mS range
Ambient temperature range	0 to 40°C (32°F to 104°F)
Ambient humidity range	10 to 90% RH
Cooling system	Forced air cooling with fan
Withstanding voltage	
Between DC input terminal and chassis	±250 V DC
Insulation resistances	
Between DC input terminal and chassis	20 MΩ or over, with 500 V DC
Between AC line and chassis	30 MΩ or over, with 500 V DC
Dimensions (including extrusions)	70 W × 151 H × 340 D mm [2.75 W × 5.94 H × 13.4 D in.]

Item	Specification
Weight (net)	Approx. 3 kg (6.6 lbs)
Accessories (in carton)	
Instruction manual	1 copy
Guard caps	2

* $23^{\circ}C \pm 5^{\circ}C$ ($73.4^{\circ}F \pm 9^{\circ}F$), 85% RH or less

2. OPERATION METHOD

To make the best use of the Electronic Load and to prevent damage which could be caused by inadvertent handling, pay attention to the notes mentioned in this section.

2.1 Notes Before Use

(1) AC Line Voltage

- o Operate the Load on an AC line of 108 - 132 V, 48 - 62 Hz single-phase AC.

(2) Load Input

- o Never apply any AC voltage to the DC INPUT terminal of the Load.

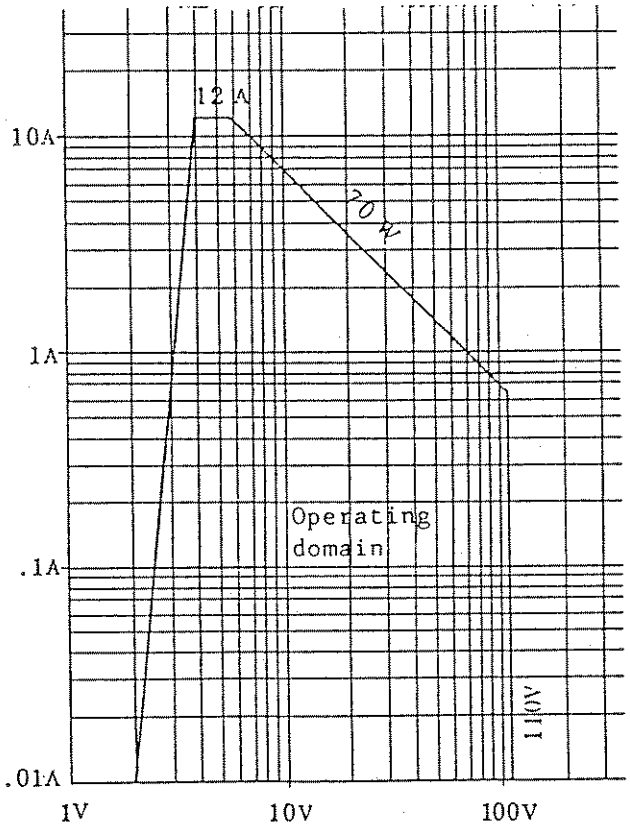


Figure 2-1-1

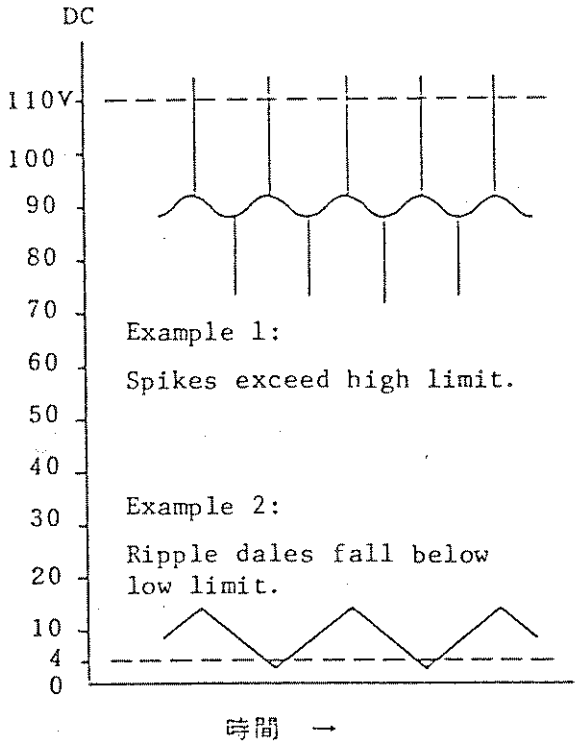


Figure 2-1-2

- The allowable input voltage range is 4 - 110 V DC. (See Figure 2-1-1.)

- Be sure to connect correctly the positive and negative lines. No loading current will flow if they are connected in the wrong polarity.

- Note that the overvoltage protector or overpower protector may not respond to such very short duration of overvoltage or overpower as may be caused by pulses or ripples superposed on the input voltage. (See Figure 2-1-2.)

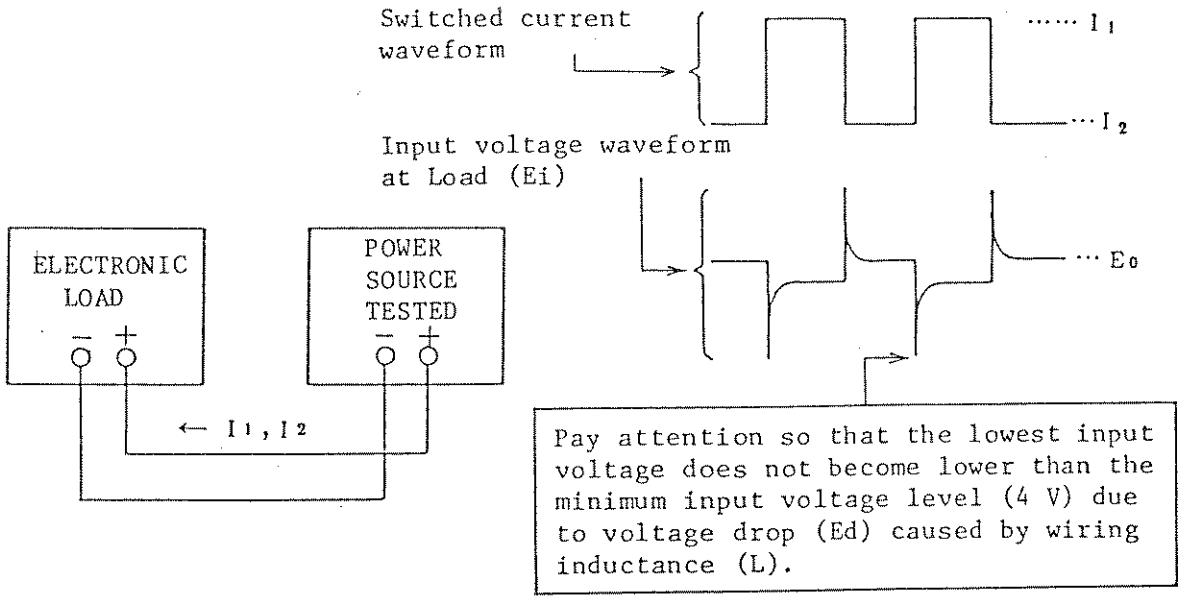
(3) Electrical Connections to Load

- For electrical connections to the Load, use sufficiently large wires of as short as possible and strand the "+" and "-" wires. Note that, when the Load is operated in the switching mode, if the current sharply varies, voltage drop may be caused by the inductance of the connecting wires and the input voltage at the Load may become lower than the low limit of the operable input range and the loading current waveform may be distorted. (See Figure 2-1-3.)

  For connection to the Load, it is recommendable to use wires of cross section 5.5 mm^2 or over and not longer than 3 meters.

  When resistors or contacts are connected in the wiring line to the Load, pay full attention to the voltage drop that will be caused by such items.

  If the input power exceeds the maximum allowable input power (70 W) of the Load when it is operating in the switching mode, the overpower protector trips. The switched current in this case will be as shown in Figure 2-1-4. Do not operate the Load in this state.



$$Ed = L\frac{di}{dt}$$

Figure 2-1-3

L: Wiring inductance

$\frac{di}{dt}$: Current change in unit time (A/sec)

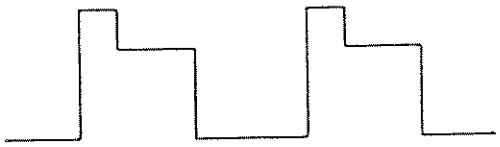


Figure 2-1-4

(4) Ambient Temperature

- The ambient temperature range for the Load to satisfy its performance specifications is 0 to 40°C (32 to 104°F). If the Load is operated in high ambient temperature or its air inlet or outlet hole is blocked, the overheat protector will trip to automatically cut out the loading current. In such a case, operate the load in a cooler place or eliminate blockage of the air inlet and outlet holes so that the overheat protector is automatically reset.

(5) Place of Use

- o Pay attention so that the air flows of the cooling air inlet and outlet holes are not impeded.
- o Avoid, whenever avoidable, to use the Load in highly humid atmosphere or dusty atmosphere.
- o Use the Load in a place where is reasonably free from vibration.

(6) Guard Caps

- o The guard caps are supplied to guard the loading current controls (LOAD A and LOAD B) against inadvertent change or unauthorized tampering. With these caps, the controls can be protected as a fixed type or semi-fixed type of controls. To use them for the semi-fixed type, break through the front surfaces of the caps using a screwdriver or other pointed tool.

Detach knob from collar.

Screw-in the guard cap.

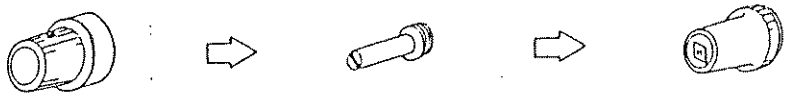


Figure 2-1-5

(7) Rear Terminal Blocks

- o Confirm that the shorting pieces of the rear terminal blocks are securely connected as shown in Figure 2-1-6. If they are not correctly connected, the Load will not operate properly.

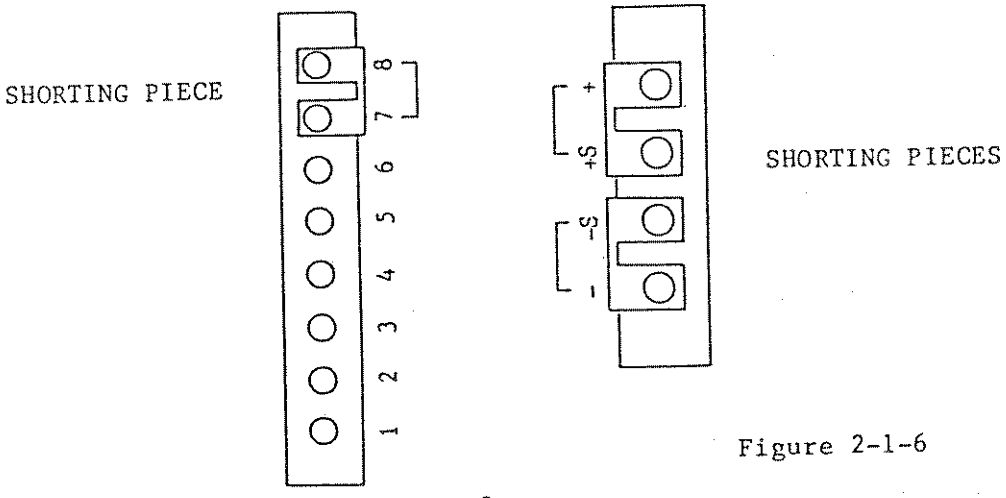


Figure 2-1-6

2.2 Description of Panel Items

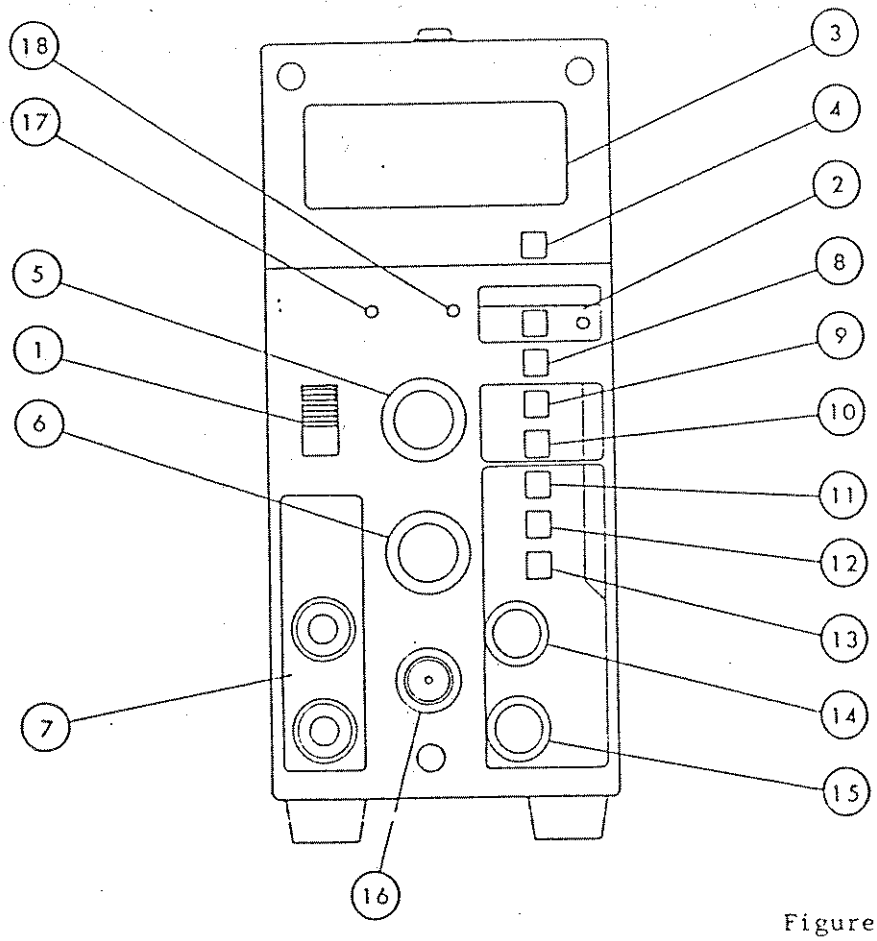
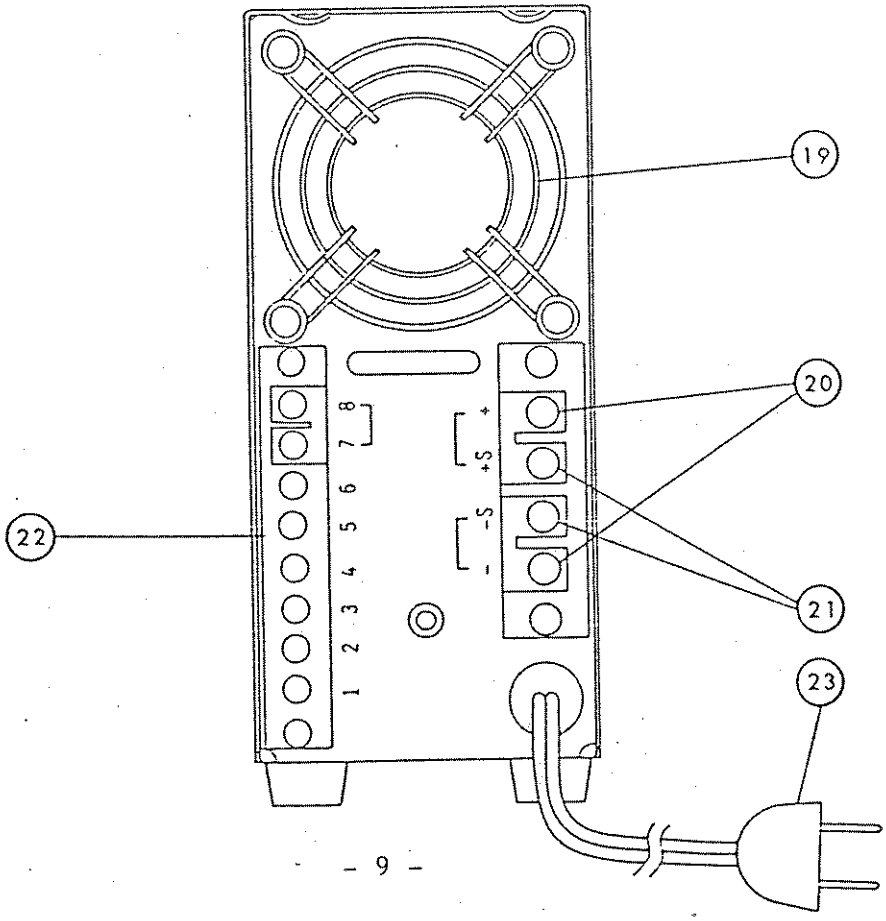


Figure 2-2-1



Description of Panel Items

(1)	POWER:	AC line power switch
(2)	LOAD:	The loading input circuit switch of the Load. This switch is automatically cut off when the overvoltage or overheat protector has tripped. When this switch is on, the red LED turns on.
(3)	VOLTMETER/AMMETER:	The digital voltmeter/ammeter with 3-1/2 digits. The voltmeter is with auto-range function. For voltmeter, "V" is displayed as unit of measure; for ammeter, "A" is displayed.
(4)	V ☐ A:	Selector switch between voltmeter and ammeter.
(5)	LOAD A:	Control for loading current A. 10-turn potentiometer to set the constant current or constant resistance.
(6)	LOAD B:	Control for loading current B. 10-turn potentiometer to set the constant current or constant resistance.
(7)	DC INPUT:	The DC input terminal of the Load.
(8)	INT ☐ EXT:	Selector switch between local mode and remote mode.
(9)	CC ☐ CR:	Selector switch between constant current (CC) mode and constant resistance (CR) mode.
(10)	12A / 0.2Ω ☐ 1.2A / 2 Ω	Range selector switch for constant current loading or constant resistance loading. (0.3 Ω minimum)
(11)	A ☐ B:	Selector switch between load A and load B.
(12)	DC ☐ SW*:	Selector switch between DC mode and switching mode. Can be used either in the CC or CR mode.
(13)	1mS ☐ 10mS:	Switching time range selector switch.

(14) A (TIME): Control to set the switching time (current flow period) for load A.

(15) B (TIME): Control to set the switching time (current flow period) for load B.

(16) CURRENT MONITOR: Terminal (BNC connector) for current monitor [10mV/A]. To set the switching current, use an oscilloscope.

(17) ALARM: Indicator lamp for trip of overvoltage protector and overheat protector. When the DC input voltage has exceeded 110 V or the Load is overheated due to insufficient cooling, this lamp turns on and the DC input circuit is cut off.

(18) POWER LIMIT: Indicator lamp for trip of overpower protector. This lamp blinks when the DC input power has exceeded 70 W.

(19) FAN: Forced cooling fan air outlet.

(20) DC INPUT "-"/"+": The DC input terminals of the Load. Connected in parallel to those of the front panel.

(21) "-S"/"+S": The input terminals for voltmeter. Connected to the "-"/"+" terminals with the shorting pieces.

(22) TERMINAL BLOCKS: Terminal blocks for remote control terminals.

(1) Terminals for remote control voltage for constant current mode.

(2) Terminals for remote control resistance for constant current mode or constant resistance mode.

(3) Terminals for one-control parallel operation.

(23) AC POWER CORD: The power cord for AC input (120 V, 50/60 Hz AC). Approx. 2.3 meters long.

2.3 Initial Setting

Before turning on the POWER switch, set the panel switches and controls as shown in the following table.

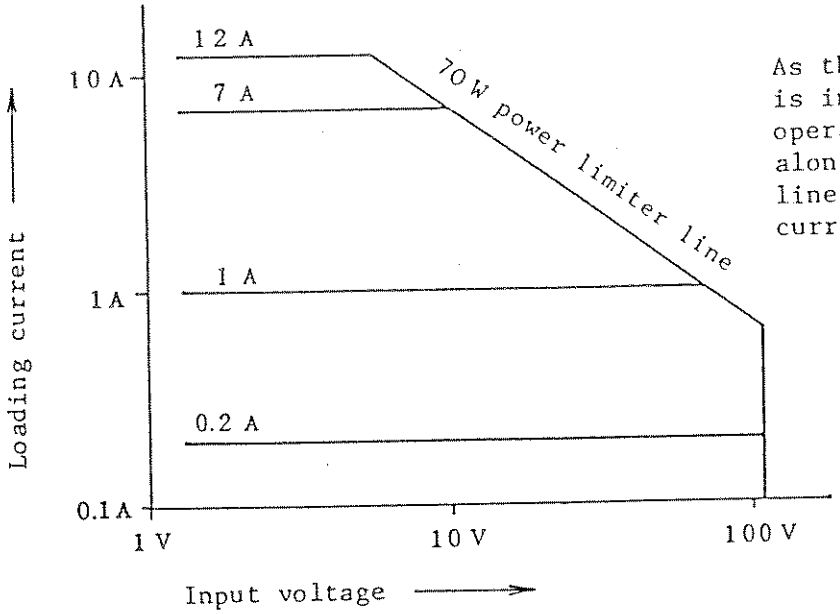
Item	No.	Setting
LOAD switch	2	OFF (⊓) state
LOAD A control	5	Counterclockwise extreme position
LOAD B control	6	Counterclockwise extreme position
A □ V switch	4	A (⊓) state
INT □ EXT switch	8	INT (⊓) state
CC □ CR switch	9	CC (⊓) state
12A / 0.2A □ 1.2A / 2 Ω switch	10	12A (⊓) state
A □ B switch	11	A (⊓) state
DC □ SW switch	12	DC (⊓) state
1mS □ 10mS switch	13	1mS (⊓) state
TIME A control	14	Mid-range
TIME B control	15	Mid-range

After the above setting is complete, turn on the POWER switch and perform the procedure mentioned in the subsequent section so that the digital voltmeter/ammeter displays 0.00A.

2.4 Operation in Constant Current Mode

- This mode of operation is such that the loading current is maintained constant irrespective of input voltage change, with input voltage versus loading current characteristics as shown in Figure 2-4-1. This feature is not attainable with regular sliding resistors.

- Typical examples of use of the Load in this mode are for constant-current discharge test of batteries and capacitors.



As the loading voltage is increased, the operating point declines along the power limiter line and the loading current is decreased.

Figure 2-4-1

(1) Connect the Load to the DC power source to be tested as shown in Figure 2-4-2.

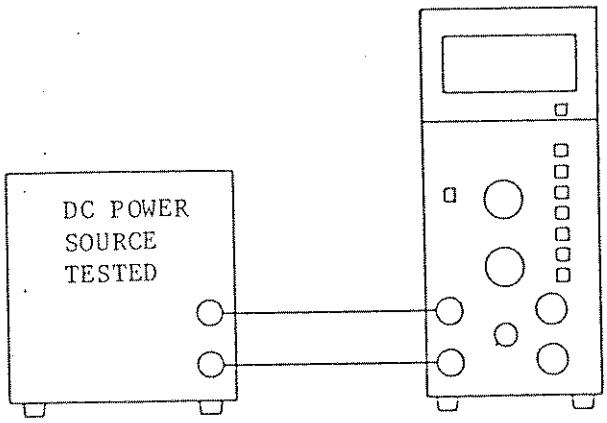
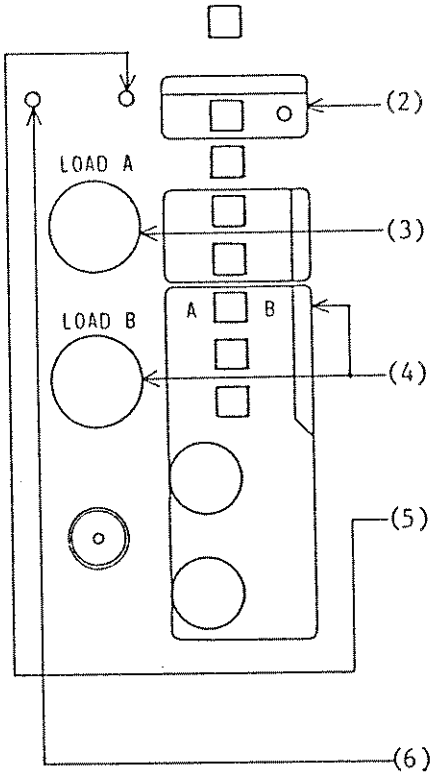


Figure 2-4-2



(2) Turn on the LOAD switch.

(3) Adjust the loading current with the LOAD A control. The digital ammeter will display the current value.

(4) If you change the A □ B switch to the B (⊓) state, the loading current is adjustable with the LOAD B control.

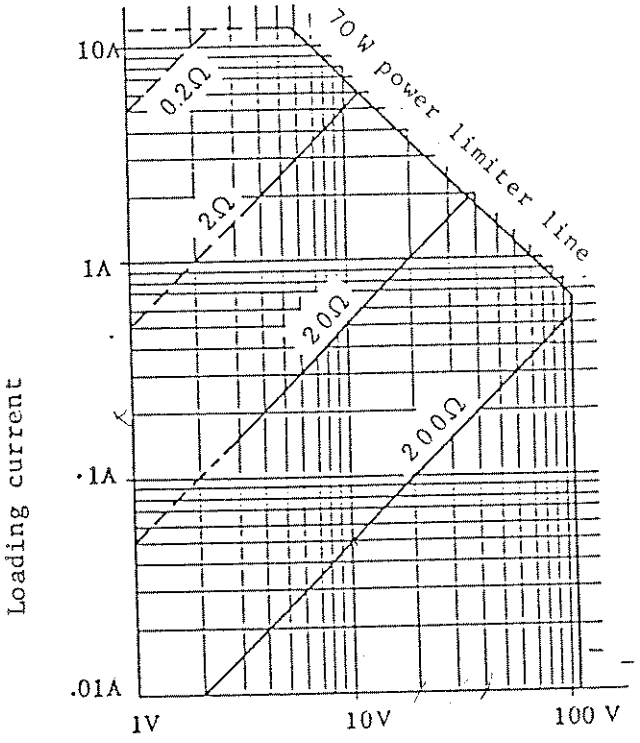
(5) If the input power fed to the DC INPUT terminal exceeds 70 W, the overpower protector trips and the POWER LIMIT lamp blinks. Blinking of the lamp means that no constant-current function is being properly done. Reduce the input power.

(6) If the loading voltage applied to the DC INPUT terminal is higher than 110 V, the overvoltage protector trips and the ALARM lamp turns on and the input circuit is cut off by the internal relay. The overvoltage protector is automatically reset as the loading voltage is reduced to lower than 110 V.

2.5 Operation in Constant Resistance Mode

- This mode of operation is identical with that when a sliding resistor is used. The characteristics are as shown in Figure 2-5-1.

- Typical examples of use of the Load in this mode are for adjustment and test of regulated DC power supplies.



The resistances can be continuously-variably adjusted with the LOAD A and B controls.

Figure 2-5-1

(1) Connect the DC INPUT terminals of the Load to the power source to be tested as shown in Figure 2-5-2.

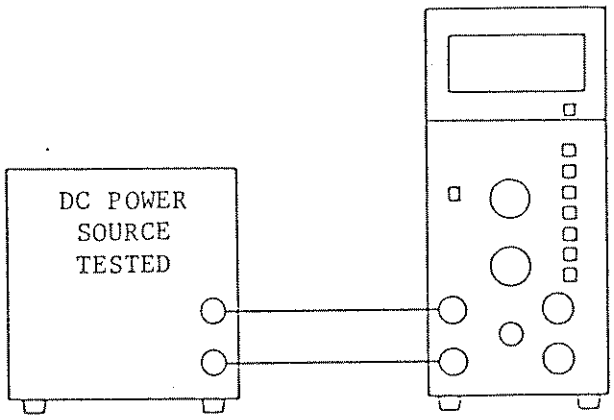
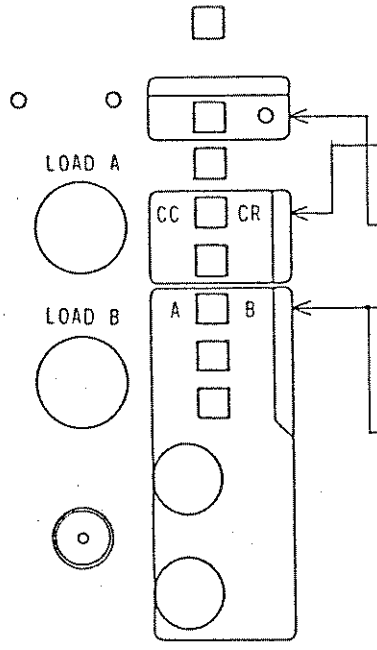


Figure 2-5-2



(2) Set the CC ☐ CR switch to the CR (⎍) state.

(3) Turn on the LOAD switch.

(4) If you set the A ☐ B switch to the A (⎍) state, the loading current (resistance) is adjustable with the LOAD A control.

(5) If you set the A ☐ B switch to the B (⎍) state, the loading current is adjustable with the LOAD B control.

(6) If the input power fed to the DC INPUT terminal exceeds 70 W, the overpower protector trips and the POWER LIMIT lamp blinks. When in this state, no constant-current function is properly done.

(7) If the loading voltage applied to the DC input terminal exceeds 110 V, the overvoltage protector trips and the ALARM lamp turns on and the input circuit is cut off by the internal relay. The overvoltage protector is automatically reset as the loading voltage is reduced to lower than 110 V.

2.6 Operation in Switching Mode

- o This mode is for test by switching the loading current between two preset levels. A typical example of use of this mode is to test the transiential response characteristics of a power source.

- o This mode of operation can be done either when in the constant current mode or in the constant resistance mode.

(1) Set the Load as in the case of the constant current or resistance mode of operation.

(2) Set the DC □ SW switch to the SW (⊓⊓) state. The load current will be switched between the levels set by the LOAD A and B controls.

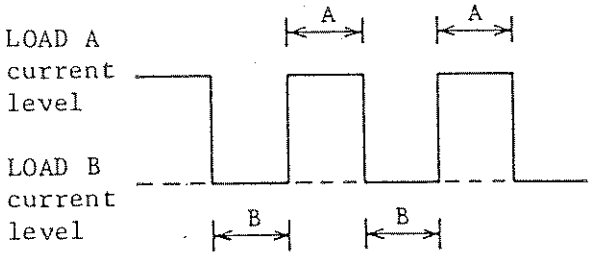
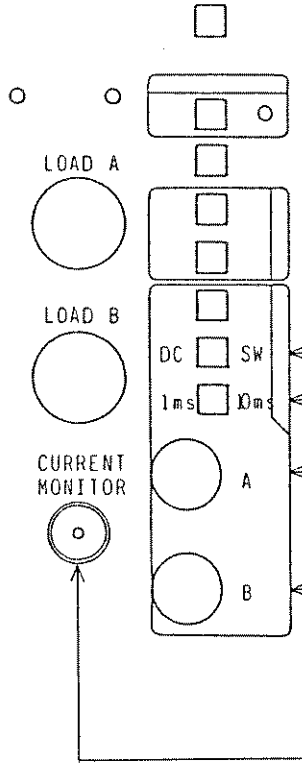


Figure 2-6-1



(3) The periods for the loading current levels of LOAD A and B can be set with the TIME A and B controls, respectively.

(4) This switch is for switching time range selection.

(5) This terminal provides an output signal to monitor the loading current waveform when in the switching mode.

2.7 Remote Sensing of Voltmeter

o The voltmeter input circuit of the digital voltmeter/ammeter of the front panel of the Load can be led out to outside of the Load for remote sensing.

(1) Set the A □ V switch of the meter section to the V (⎓) state. Normally, the digital voltmeter displays the voltage applied to the DC INPUT terminal of the Load.

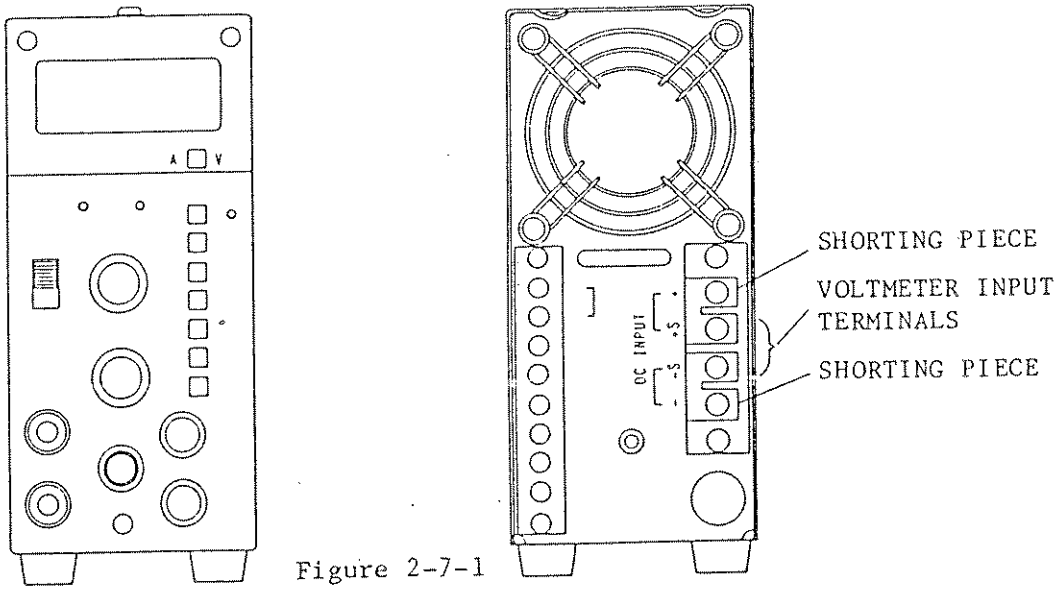
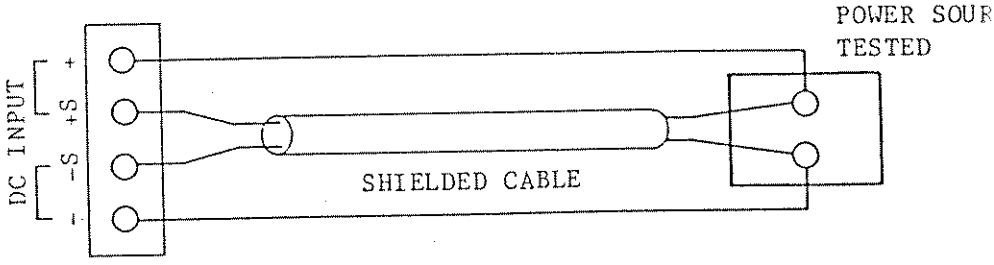


Figure 2-7-1

The input voltage of the voltmeter is connected to the "+"/"-" terminals with the shorting pieces at the DC INPUT terminal section of the rear panel.

(2) By disconnecting the shorting pieces and extending the voltmeter input circuit to the power source to be tested, voltage measurement can be done eliminating the errors caused by the voltage drop in the wires which connect the Load to the power source tested. Refer to Page 6 of "(3) Electrical Connections to Load."



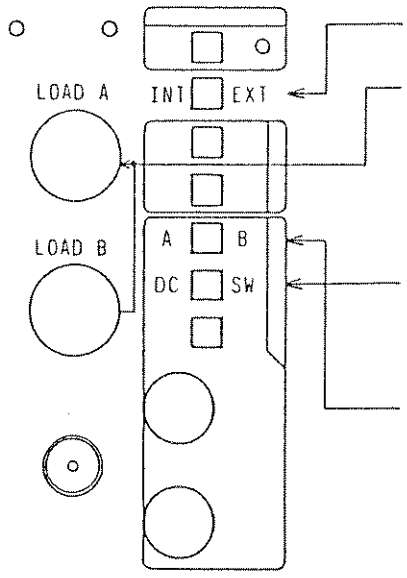
The wires for connection to the power source tested may be connected to the DC INPUT terminals on the front panel of the LOAD.

Figure 2-7-2

2.8 Remote Control of Constant Current Mode

o When in the constant current mode of operation, the loading current can be remote-controlled with a voltage signal or a resistance signal.

(1) Control with voltage signal



Set the INT ☐ EXT switch to the EXT (⎍) state.

The LOAD A and B controls are for setting of the full-scale current values. Turn them to the clockwise extreme positions and replace their knobs with the guard caps supplied as accessories.

When in the remote control mode, the swiching function can not be done. Be sure to set the DC ☐ SW switch in the DC (⎍) state.

The A ☐ B switch may be set in either state. Adjust the full-scale current value with the corresponding LOAD control.

Apply the external control signal for remote control to the terminals as shown in Figure 2-8-1. With a control voltage signal of 0 - 10 V, the loading current can be controlled for a range of 0 - 12 A.

Input/Output terminals for one-control parallel operation

Voltage signal input terminals for remote control of constant current operation

Resistance signal input terminals for remote control of constant current operation or constant resistance operation
(Selection in the casing needed.)

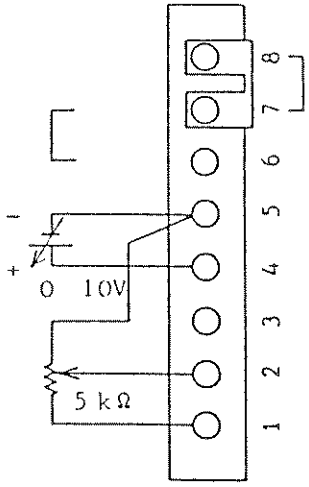


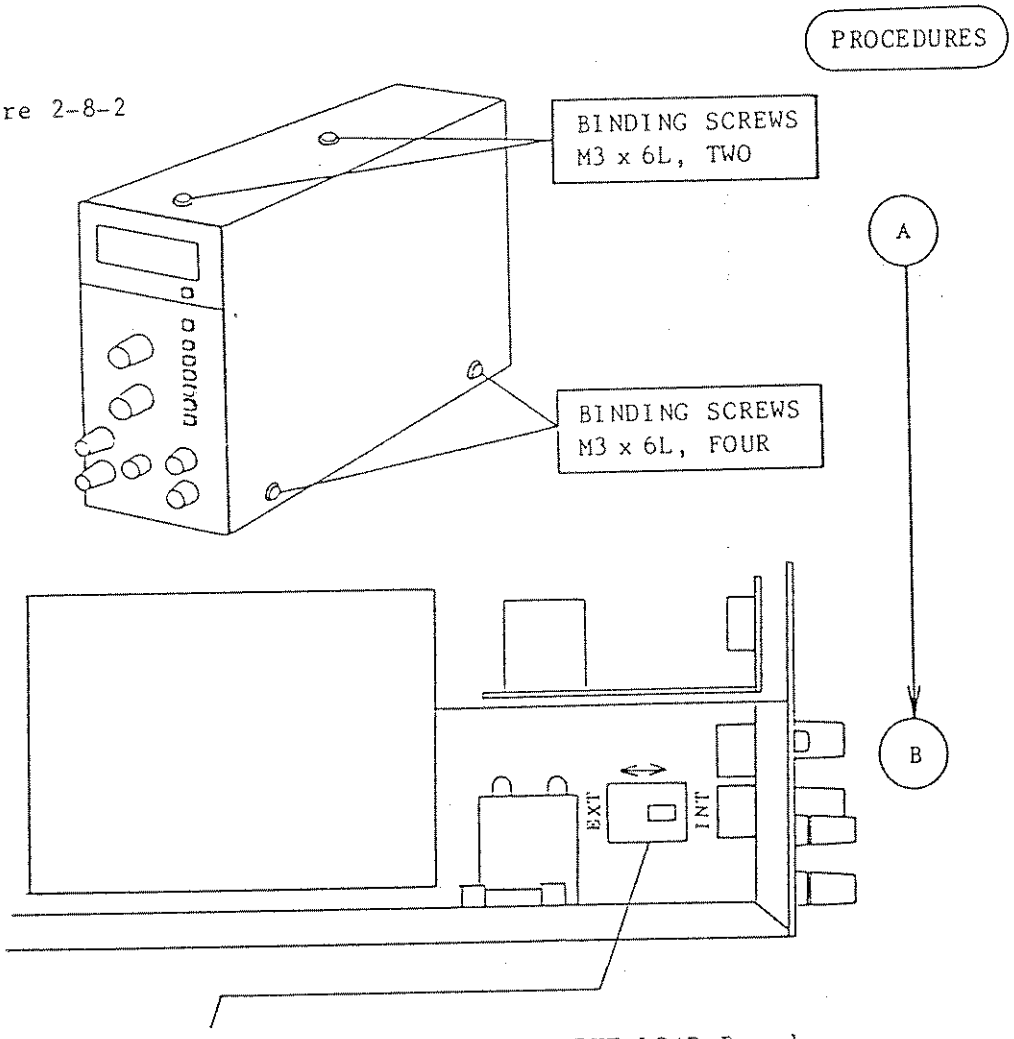
Figure 2-8-1

(2) Control with resistance signal

This mode is identical in effect with that the LOAD B control on the front panel is extended to a remote position. So, this mode is referred to as EXT LOAD B mode.

For this mode, the internal slide switch must be changed as shown in Figure 2-8-2. Remove the cover and change the slide switch following the procedures A and B shown in Figure 2-8-2.

Figure 2-8-2

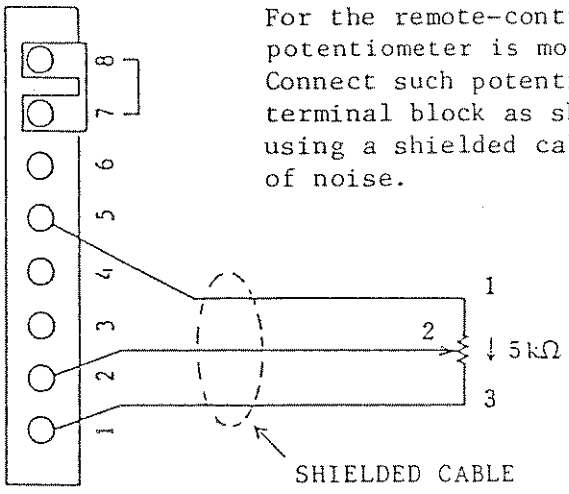


Slide Switch EXT: For EXT LOAD B mode

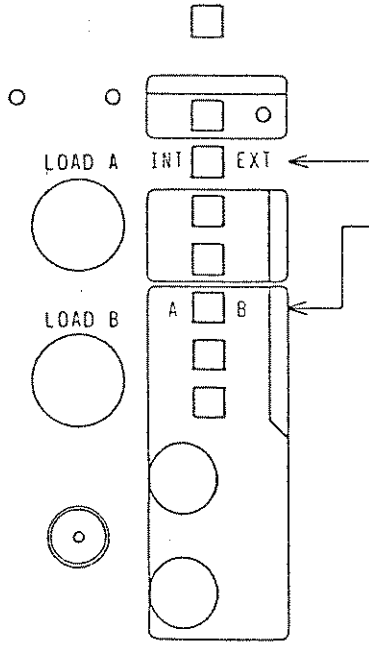
INT: LOAD B control of front panel becomes effective.

Be sure to set the slide switch in the INT position when the EXT LOAD B mode is not used.

After changing the slide switch as above, fix the cover in the original position and then proceed to the next step of operation.



For the remote-control resistor, a 5-kΩ potentiometer is most recommendable. Connect such potentiometer to the rear terminal block as shown in Figure 2-8-3, using a shielded cable to prevent introduction of noise.



Set the switches on the front panel of the load as follows:

Set the INT □ EXT switch to the INT (⊓) state.

Set the A □ B switch to the B (⊓) state.

By the above procedure, preparation for the EXT LOAD B mode of operation is complete. The switches and controls on the front panel remain effective except the LOAD B control.

2.9 Remote Control of Constant Resistance Operation

- o When in the constant resistance mode of opreation, the loading resistance can be remote-controlled with a resistance signal in the procedure of 2.8 (2).

2.10 One-control Parallel Operation

o Two or more units can be connected in parallel to increase the loading current capacity and the operations of such units can be controlled by controlling only one of the units connected in parallel. (In a master/slave system with the selected one as the master unit and the others as slave units.) For the following explanation, refer to Figure 2-9-1.

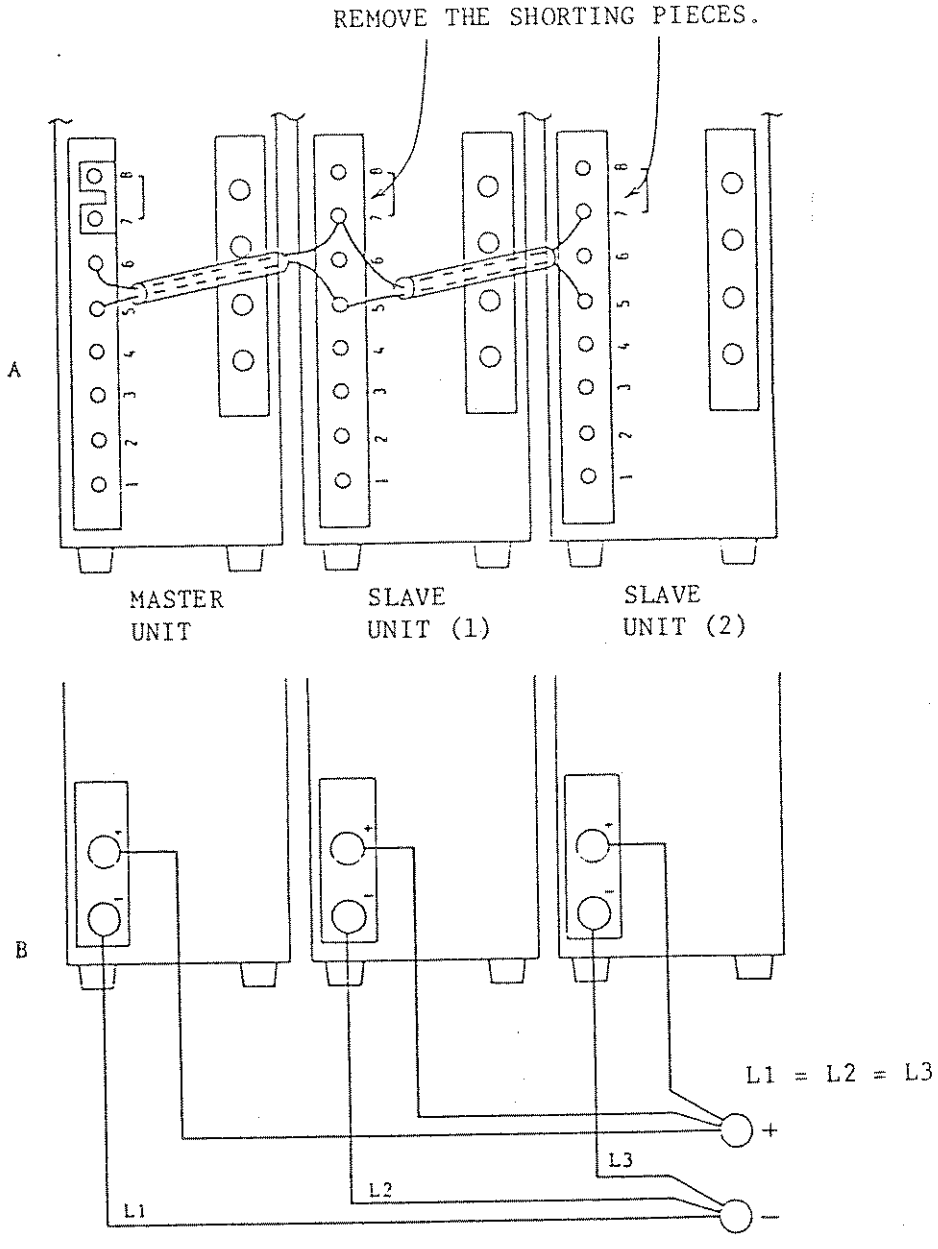


Figure 2-9-1

(1) Turn off the POWER switch.

(2) Remove the shorting piece from between terminals ⑦ and ⑧ of the remote-control terminal block.

(3) Connect terminals ⑤ and ⑥ of the master unit to terminals ⑤ and ⑦ of all slave units, using 2-conductor shielded cables and connecting the shielding wires to the "-" terminals.

(4) Connect the DC INPUT terminals of all units to the output of the DC power source to be tested.

Make equal the lengths of the wires of the negative lines for load connections.

L1 = L2 = L3

Set the switches and controls of the slave units as follows:

(a) Set the LOAD switch to the ON (⊓) state.

(b) Set the A □ B switch to the A (⊓) state.

(c) Turn on the POWER switch.

Other switches and controls may be set in any states since they remain idle.

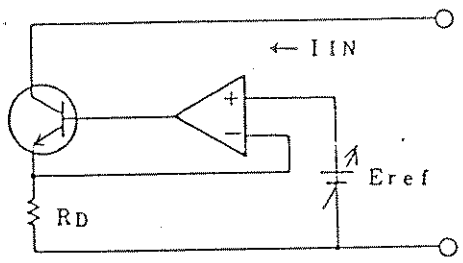
When the above procedure is complete, all units can be controlled by controlling the master unit alone.

Note that approximately 10% of ununiformity of loading currents of individual units may result due to ununiformity of the internal current detector resistances and that of input wiring resistances.

3. OPERATING PRINCIPLES

3.1 Constant Current Operation

This mode of operation is to let the Load draw a constant loading current irrespective of loading voltage change. This is accomplished by employing a reference voltage source (E_{ref}) and a current detecting resistor (R_D) and connecting them with a negative feedback circuit (an error amplifier) so that the voltage drop across R_D is maintained equal to E_{ref}, as shown in Figure 3-1-1. With this circuitry, the loading current (I_{IN}) is determined by E_{ref} and R_D only and is not a function of the loading voltage.

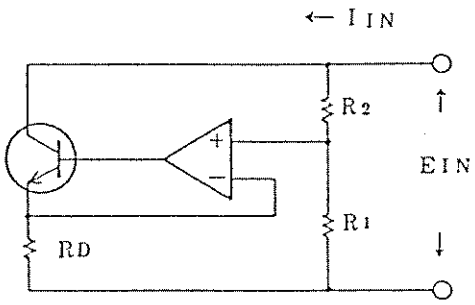


$$I_{IN} = \frac{E_{ref}\ [V]}{RD\ [\Omega]}$$

Figure 3-1-1

3.2 Constant Resistance Operation

This mode of operation is to let the Load draw a loading current (I_{IN}) which is directly proportional to the loading voltage (E_{IN}). This is accomplished employing a circuitry with negative feedback circuit (error amplifier) as shown in Figure 3-1-2. With this circuitry, the equivalent resistance (R_E) as viewed from the input circuit of the Load is determined by the input voltage dividing ratio $R_1/(R_1 + R_2)$ of the loading voltage and the current detecting resistor (R_D).



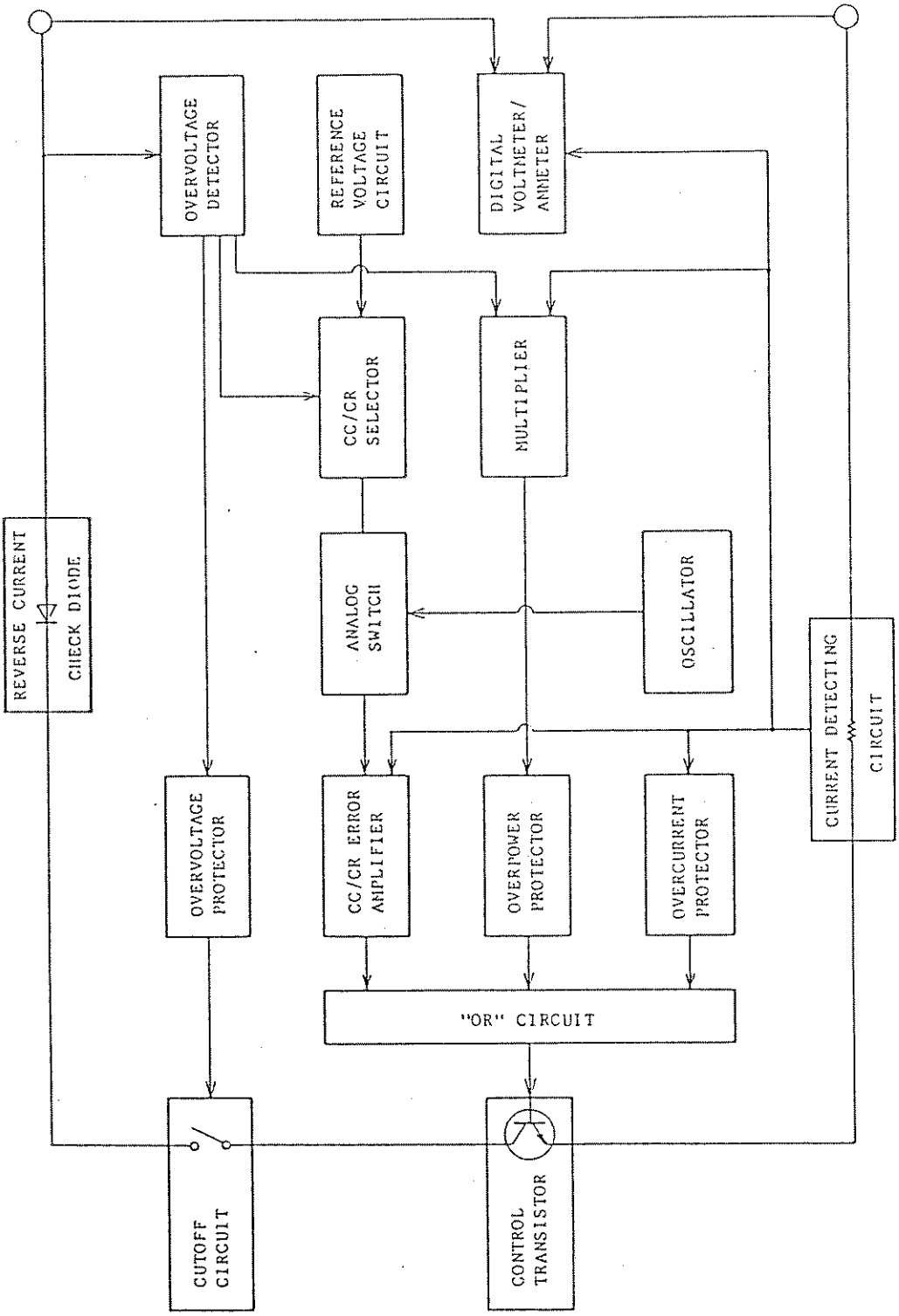
$$I_{IN} = \frac{R_1}{R_1 + R_2} \cdot \frac{E_{IN}\ [V]}{R_D\ [\Omega]}$$

$$= \frac{E_{IN}\ [V]}{R_E\ [\Omega]}$$

where, $\frac{1}{R_E} = \frac{R1}{R_1 + R_2} \cdot \frac{1}{R_D}$

Figure 3-1-2

3.3 Block Diagram



4. MAINTENANCE

It is most recommendable to inspect, clean, and calibrate the Electronic Load periodically. For critical calibrations which require special knowledge, please order your Kikusui agent.

4.1 Removing the Casing Cover

To remove the casing cover, remove the two top screws and four side screws (see Figure 4-1-1) and then pull up the casing cover.

Note: When installing the casing cover, be sure to use the screws that have been removed.

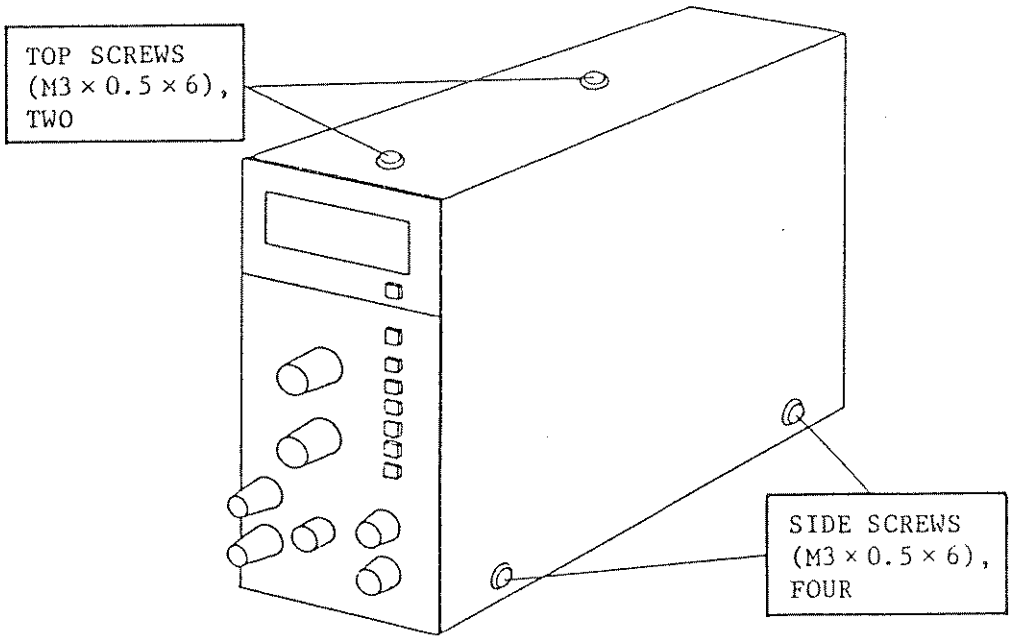


Figure 4-1-1

4.2 Inspection and Cleaning

(1) Cleaning

Clean the panel and cover using a cloth moistened with neutral soapsuds or alcohol and then wipe them thoroughly with a dry cloth. Never use such chemical detergent as thinner or benzine.

Use a compressed air to blow dust collected on chassis and air ventilation channels.

(2) Inspecting the Power Cord

Check for breakage of the vinyl sheath of the cable and for loosening or brakage of the plug.

4.3 Calibration of Digital Voltmeter/Ammeter

Calibrate the digital meter as an ammeter at first. Prepare a test setup as shown in Figure 4-3-1. Turn on the power and allow a stabilization time of approximately 30 minutes before starting calibration.

(1) Instruments Required for Calibration

Digital multimeter (4-1/2 digits; Kikusui Model 1504 or an equivalent) 1

Standard shunt resistor (50 A, 100 mV, accuracy 0.05%) .. 1

Regulated DC power source (0 - 110 V DC, 20 A) 1

(2) Test Setup

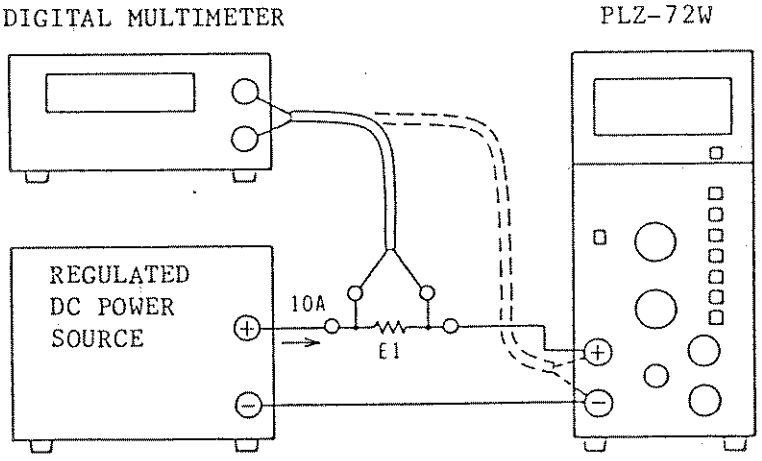


Figure 4-3-1

(a) Prepare a test setup as shown in Figure 4-3-1. Set the loading current at 12.00 A and allow a stabilization period of approximately 30 minutes.

(b) For voltage E_1 detected by the shunt resistor, re-adjust the loading current so that the digital multimeter reads 24.00 mV.

(c) Adjust RV603 so that the ammeter of the Load reads 12.00 A.

(d) Change the A □ V switch to the V (⌐) state to start voltmeter calibration.

(e) Set the LOAD OFF □ ON switch to the OFF (⌐) state to make the loading current zero.

(f) Connect the input terminal of the digital multimeter to the DC Input terminal of the Load.

(g) Set the output voltage of the regulated DC power source at 19.00 V.

(h) Adjust VR602 so that the voltmeter of the Load reads 19.00 V.

(i) Set the output voltage of the regulated DC source at 100.00 V.

(j) Adjust RV604 so that the voltmeter of the Load reads 100.0 V.

(k) Adjust RV311 so that auto-range switching function occurs within 19.00 - 19.50 V.

4.4 Range Calibration (0.2Ω/2Ω) for Constant Resistance Operation

The Electronic Load is incorporated with range controls for the constant current mode and constant resistance mode, controls for remote-control sensitivities, and controls for protectors. Calibrate these controls as explained in this section and subsequent sections. The instruments required and the test setup are identical with those mentioned in Section 4-3.

(a) Set the CC □ CR switch to the CR (⌐) state and the $\frac{12A}{0.2\Omega}$ □ $\frac{1.2A}{2\Omega}$ switch to the $\frac{1.2A}{2\Omega}$ (⌐) state.

(b) Set the LOAD A/B selector switch (A □ B switch) to the A (⌐) state. Turn the LOAD A control to the clockwise extreme position.

(c) Adjust the output voltage of the regulated DC power source connected to the DC INPUT terminal of the Load, so that the voltmeter of the Load reads 10.00 V. Under this state, adjust RV301 so that the loading current becomes 5.50 A.

(d) Reduce the loading current to 0.55 A with the LOAD A control.

(e) Change the $\frac{12A}{0.2\Omega} \square \frac{1.2A}{2\Omega}$ switch to the $\frac{12A}{0.2\Omega}$ (⊓) state. Adjust RV302 so that the loading current becomes 5.50 A.

By the above procedure, calibration of the 0.2Ω range and 2Ω range for constant resistance operation is over.

4.5 Range Calibration for Constant Current Operation

This calibration is for the 1.2A range only. The 12A range of this mode of operation is fixed.

(a) Set the CC □ CR switch to the CC (⊓) state.

(b) Set the $\frac{12A}{0.2\Omega} \square \frac{1.2A}{2\Omega}$ switch to the $\frac{12A}{0.2\Omega}$ (⊓) state.

(c) Set the loading current at 12.00 A.

(d) Change the $\frac{12A}{0.2\Omega} \square \frac{1.2A}{2\Omega}$ switch to the $\frac{1.2A}{0.2\Omega}$ (⊔) state.

(e) Adjust RV306 so that the loading current becomes 1.20 A.

(f) Turn the LOAD A control to the counterclockwise extreme position so that the loading current becomes zero.

(g) Adjust offset with RV307. As you turn this control potentiometer (screwdriver adjustment type) clockwise or counterclockwise, a small loading current will flow. Gradually reduce the current to zero by adjusting this control.

By the above procedure, range calibration for the constant current operation is over.

4.6 Calibration of Remote Control Voltage for Constant Current Operation

This calibration is to attain such state that a loading current of 12 A is dwawn when a remote control voltage of +10 V is applied. Turn the LOAD A and B controls to the clockwise extreme position beforehand.

(a) Apply a voltage of 10.00 V DC between terminals 4 and 5 as shown in Figure 2-8-1.

(b) Set the INT □ EXT switch to the EXT (⌐¬) state.

(c) Adjust RV303 so that the loading current becomes 12.00 A.

4.7 Adjustment of Overcurrent Protector

This adjustment is to set the trip point of the overcurrent protector at 12 A of loading current in order to prevent degradation and damage of components which could be caused by overcurrent.

(a) Set the Load in the 0.2Ω range of constant resistance operation. Turn the LOAD control to the clockwise extreme position.

(b) Apply a voltage of 4 V DC to the DC INPUT terminal.

(c) Adjust RV312 so that the loading current becomes 12.3 - 12.5 A.

4.8 Adjustment of Overvoltage Protector

This adjustment is to set the trip point of the overvoltage protector at 115 - 120 V DC. When the overvoltage protector has tripped, the loading voltage is cut off by an internal protective relay.

(a) Set the loading current at 0.1 A. Adjust RV601 so that the protective relay trips at 115 - 120 V DC.

4.9 Calibration of Current Monitor

This calibration is to set the current monitor sensitivity at 10 mV/A.

(a) Set the loading current at 10.00 A.

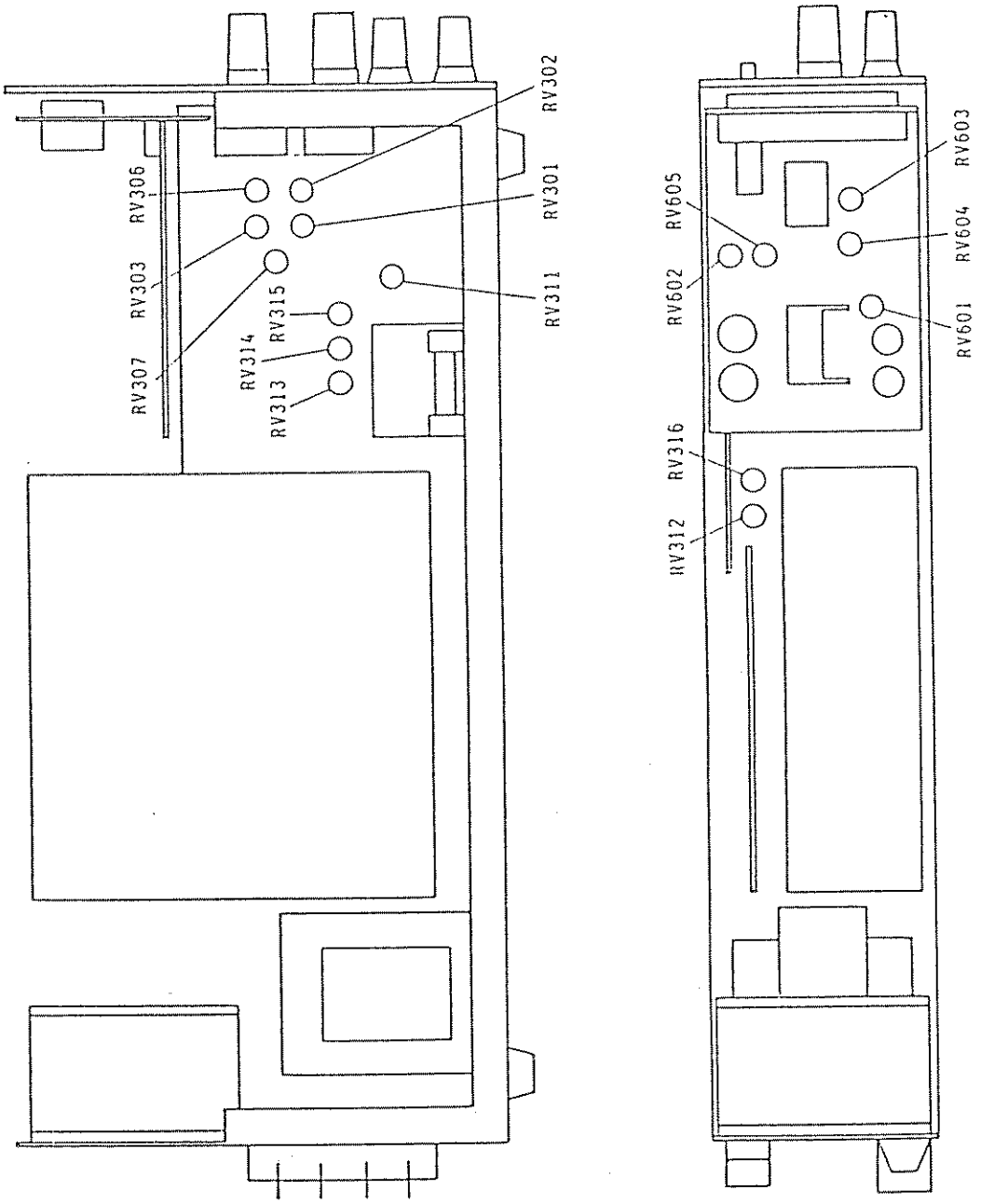
(b) Connect a digital multimeter to the CURRENT MONITOR terminal and adjust RV605 so that the output voltage becomes 100 mV.

4.10 Troubleshooting

When operation of the Electronic Load is abnormal, check the items shown in the following table. If the Load itself is malfunctioning, please order your Kikusui agent for repair service.

Symptom	Check item	Cause (remedy)
No loading current flows.	1. Is not the red ALARM lamp on?	o The loading voltage is higher than 110 V. o Air ventilation hole is blocked.
	2. Is not the yellow POWER LIMIT lamp blinking?	o The loading power is larger than 70 W.
	3. Has the LOAD switch been turned on?	o If the LOAD switch is off, turn it on.
	4. Is the INT EXT switch correctly set?	o If the switch is in the EXT state, change it to the INT state.
	5. Is the shorting piece between control terminals 7 and 8 on the rear panel securely connected?	o If the shorting piece is loose or disconnected, connect it securely.
Loading current cannot be varied.	1. Is not the yellow POWER LIMIT lamp blinking?	o The loading power is larger than 70 W.
	2. Is not the loading current larger than 12 A?	o If the loading current is larger than 12 A, reduce it.
	3. Is not the loading current too low?	o The loading current must not be lower than 4 V.
	4. Is setting of A B switch correctly corresponding with LOAD A or LOAD B control?	o The loading current is not adjustable unless the switch setting and control mutually conform.
Switching is unsuccessful.	1. Is DC SW switch correctly set?	o If the switch is set in the DC state, change it to the SW state.
	2. Are the LOAD A current and LOAD B current correctly set?	o Switching is unsuccessful if LOAD A = LOAD B.

4.11 Layout of Controls



5.1 Rack Mount Frame and Brackets

The Electronic Load can be installed on a standard rack by using brackets (B23) and a frame (RMF-4 or RMF-4M).

PLZ-72W	+	B24	+	RMF-4	→	EIA rack (19 in.)
PLZ-72W	+	B24	+	RMF-4M	→	JIS rack (mm-unit rack)

(1) Fix the brackets on the Loads. (Up to three units of Loads can be fixed together with the brackets.)

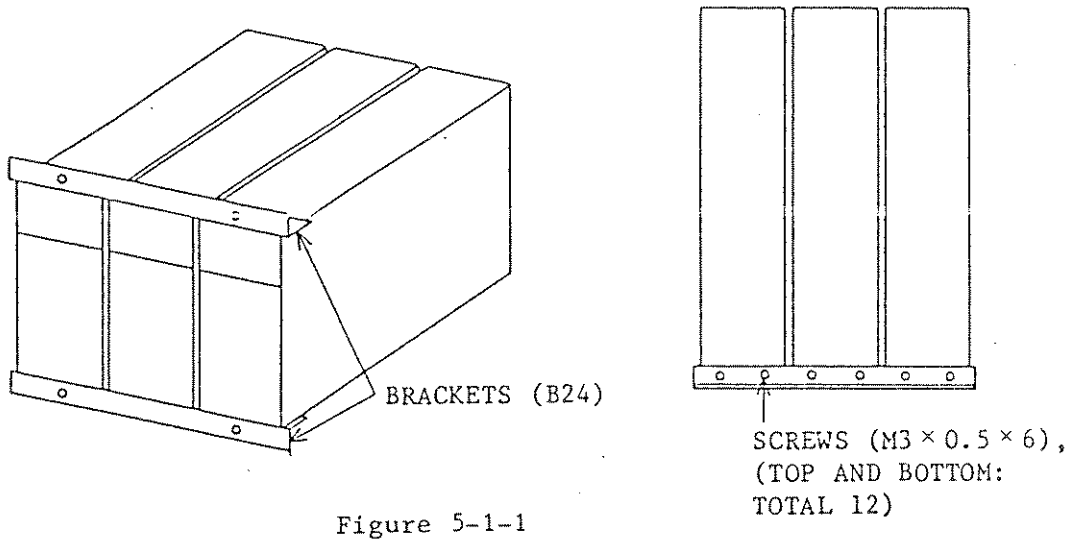


Figure 5-1-1

(2) Install the Loads in the frame (RMF-4 or RMF-4M) as shown in Figure 5-1-2.

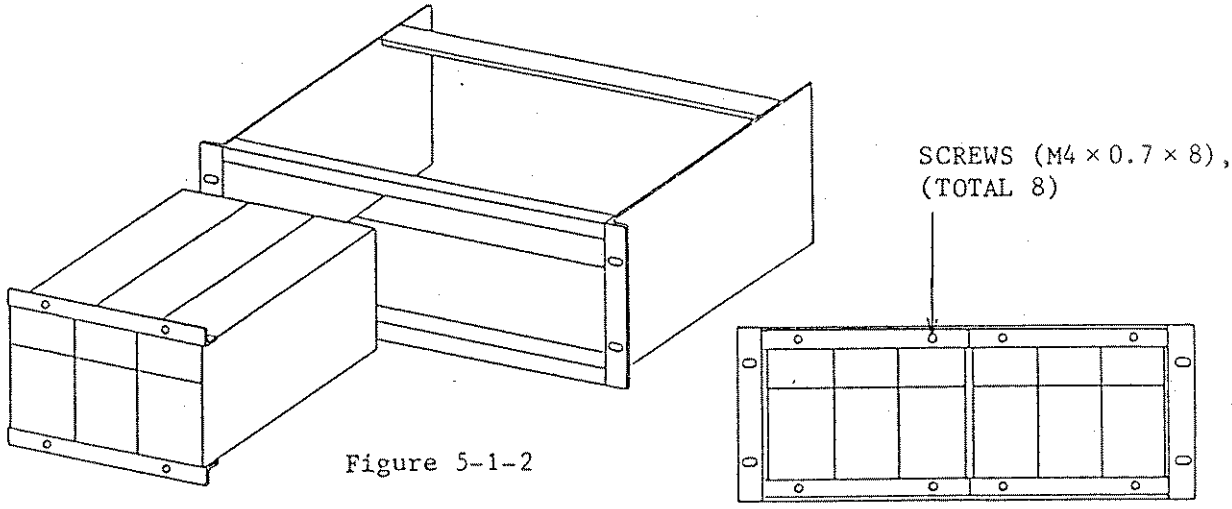


Figure 5-1-2

DRAWING NO 317952

DC INPUT +

DC INPUT + +S

RL401

LYIF AC 100V

CR407 C10DK201 OR SNR10A130K

CR404 Q20C

J306 P306

J303

P502

A555, A556 METER UNIT

P603 J603

CURRENT MONITOR 10mV/A

TS401

J403 P304

A554 POWER UNIT

A553 CONTROL UNIT

J302A P302A

RV305 LOAD B 5KB

RV304 LOAD A 5KB

P601 J601

P602 J602

P308 J308

J302B P302B

P305 T305

P301 J301

R420 0.05

T401

117V 100V 18V 0 18V 117V 100V 10V 0 10V 0

C401 0.1M 630V

F401 S401

CR406 ERZ-C10DK201 OR SNR10A130K

B401

-S

-

DATE	APP. BY	REV. BY	CONTENTS
59.12.14	山本	山本	CR407 C10DK201 追加
1-3.10.22	〃	〃	Job 32.69 100%

KIKUSUI ELECTRONICS CORPORATION

TITLE: MODEL PLZ 72W CIRCUIT DIAGRAM

CODE NO.

DRAWING NO. 317952

8203 IKSK15

DRAWING NO 317953

CONTENTS

	DATE	APP. BY	REV. BY
⚠	59.12.13	山内	山内
⚠	59.3.1	山内	山内
⚠	59.10.22	山内	山内

⚠ 59.10.22 R313 6.8K→2.2K に変更 S309 接点 S302 接点 EXT 追加

TO A/V METER A556

A553

P301 10 9 8 7 4 3 5 6 2 1

EXT CR IN · -S · +S · SLAVE IN · EXT CC IN

P308 3 2 4 1

P304 2 +15V 3 -15V

RV306 10KB · S309 · EXT

+15V · R305 560 · R304 Δ27K · S302 · EXT · CC · CR · S303 · INT

CR302 1N937A

R303 Δ6.8K · RV303 5KB

S304 · 12A · 1.2A · R302 Δ5.1K · R301 75K · RV302 5KB · RV301 50KB · CR301 RD5.1JB

RV307 50K · R308 6.8M ½W · R307 1K · R313 6.8K · CR317 RD9.1JB · CR304 1S1588 · U301 157C · C301 330P · R309 1K · R310 10M ½W · -15V

R306 1K · CR303 RD5.1JB

U302 HD14052B

C306 0.01M · R322 3.3K · CR308 1S1588 · U304D 451C · -CV · R323 47 · R324 33K · -15V

TO U304B No.1
FROM CR312
TO U305 No.2
TO R328
FROM CR313, CR315

FROM U304A No.14

OPTION

P307 J307

+15V · -15V

Q301 C372 · R321 15K · R320 22K · CR305 1S1588

C304 33MF 25V · R314 100 · R317 10K · R316 8.2K · R315 1M · R318 3.3K · U303B 251C · C303 0.22M · C302 2.2MF · R319 100 · C305 33MF 25V · 1mS · S307 · 10mS

S305 · A · B · DC · SW · S306

TIME A · RV308 100KB · CR306 1S1588

RV309 100KB · CR307 1S1588

TIME B

R 301 ~ 324
RV 301 ~ 309
C 301 ~ 306
CR 301 ~ 317
Q 301

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL PLZ 72W
A553 (1/2)
CIRCUIT DIAGRAM

CODE NO.

DRAWING 317953

8203 1KSK15

RV304

DRAWING NO. 317954

CONTENTS | DATE | APP. BY | REV. BY

P304 No. 8 12 9 1

U301 PIN No.5

+15V

CR309 S5277J

RL301 MZ24S

P306 2 1

CR310 TLR206

TO P307 No.1

FROM +S P301 No.3

J303

TO ALARM LAMP 1

2

4

TO POWER LIMIT LAMP 6

R332 2.2K

CR311 IS1588

+15V

LOAD

S301

R330 1M

R328 1K

R329 10K

U303A 251C

U304A 451C

R326 Δ390K

R327 Δ39K

R331 3.9K

RV311 10KB

OVP

R357 10K

CR312 IS1588

U305B 251C

U305A 251C

R336 4.7K

R337 33K

C307 3.3M

-15V

R335 68K

+15V

R333 33K

R334 100

R358 680 1/2W

R355 4.7

+15V

P305

CR316 S1VB20

C317 220MF 50V

C315 0.0022M

C313 100MF 25V

U308

C316 0.0022M

C314 100MF 25V

C318 220MF 50V

R356 4.7

-15V

R359 680 1/2W

CR313 IS1588

C308 0.001M

R339 3.3K

U306A 251C

+15V

R340 47K

R341 100K

Q302 C372

R342 4.7K

C309 3.3MF 35V

RV312 5KB ← CURRENT LIMIT

-15V

+15V

Q303 A1015

R345 Δ1.5K

X RV315 20K

Y RV314 20K

Z RV313 20K

R351 47K

CR314 IS1588

R349 10K

R354 3.9K

U304C 451C

R352 10K

R353 1K

C311 33M 25V

C312 33M 25V

R350 15K

-15V

FLASHING OSC.

R346 Δ1.5K

-15V

C310 0.0022M

R347 3.3K

U306B 251C

CR315 IS1588

U307

P305

P306

U304B 451C

+15V

R348 47K

RV316 5KB ← POWER LIMIT

R344 12K

R343 1K

A553

R 326 ~ 359
RV 311 ~ 316
C 307 ~ 317
CR 309 ~ 316
Q 302, 303

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL PLZ 72W
A553 (2/2)
CIRCUIT DIAGRAM

CODE NO.

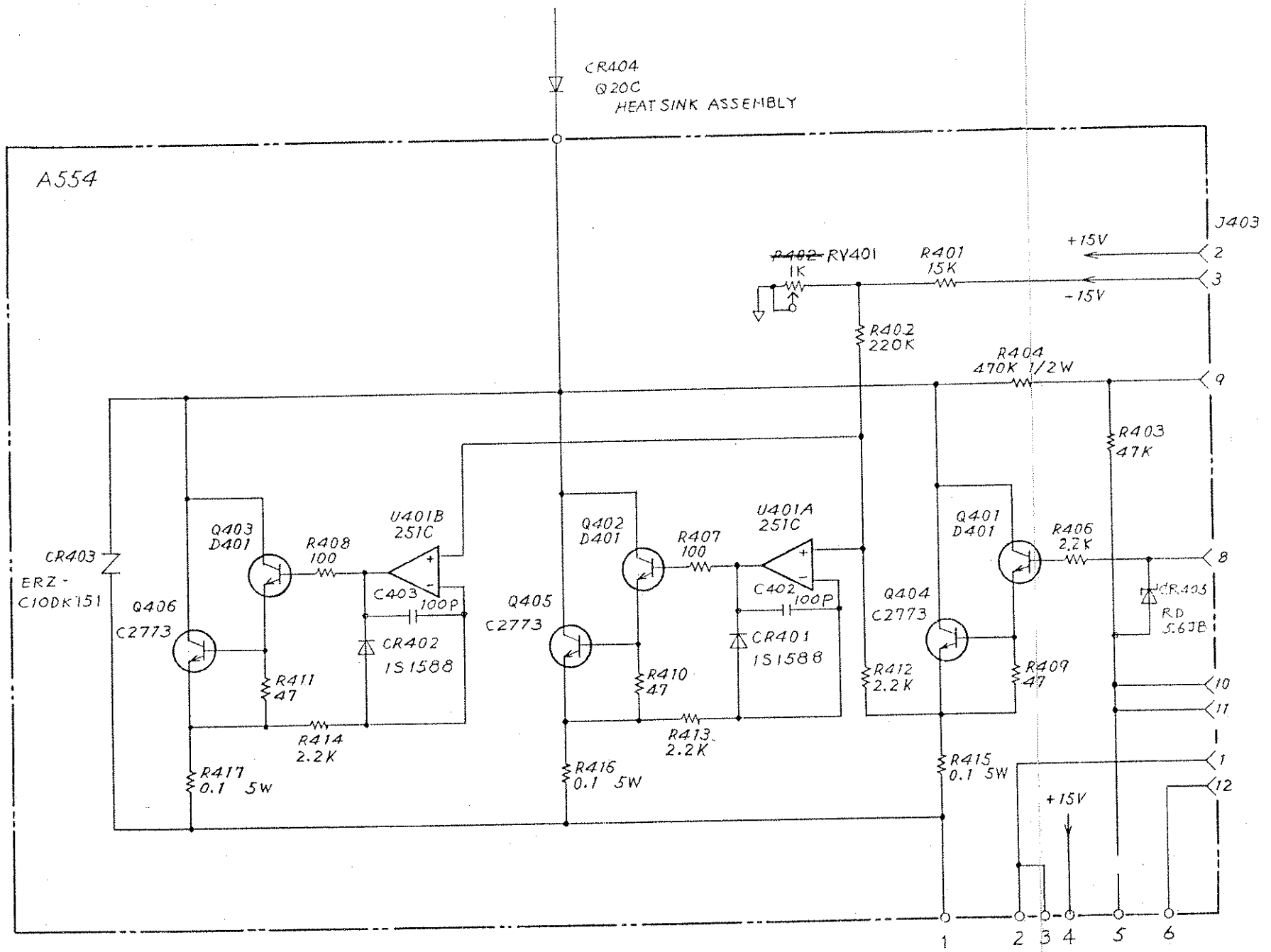
DRAWING NO. 317954

8203 IKSK15

DRAWING NO. 317955

CONTENTS

	DATE	APP. BY	REV. BY	CONTENTS
⚠				
⚠S9.12.13	11/4			R406 2.2K に変更
⚠S9.3.	〃 4			R402 470 → RV401 1K に変更
⚠	1 Sep. 10 '28	11/4		



* ADJUSTED IN FACTORY

C 401 ~ 402
R 401 ~ 417
CR 401 ~ 404
Q 401 ~ 406
U 401

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL PLZ 72W
A554
CIRCUIT DIAGRAM

CODE NO.

DRAWING NO. 317955

8203 IKSK 15

DRAWING NO 317956

A555

J502
CR502 TLY 206
ALARM
CR503 TLR 206
POWER LIMIT

CR504 TLR313
CR505 TLR313
CR506 TLR313
CR507 TLR313
CR508 TLR313

R506 100

U501
C507 33MF 25V

R504 100K
C501 100P
R501 Δ2.2K
R502 Δ2K
CR501 ICL 8069 CCQ
R503 Δ1K
C502 0.1M
C503 0.01M
C504 0.1M
R505 Δ240K
C505 0.22M
C506 33MF 25V
DG

P501
J601

S601
V
A
NC
RV603 50K
R616 Δ39K
RV604 5K
R617 Δ5.1K
R620 10K
R614 Δ330K
RV602 100KB
R615 Δ24K
R618 Δ5.1K
RV605 5KB
R619 Δ10
CURRENT MONITOR

P602
P603
P601

Q604 B536
R612 100
R611 1K
R609 1K
CR605 1588
R610 27K
CR604 S5277J
RL601 MZ12S
R608 150
R605 47K
U602 78L05
Q603 C372
Q602 C372
R607 5.6K
CR603 1588
R606 470
CR608 1S1588
C602 33MF 25V
U601 151C
R604 1M
C604 100MF 25V
C603 0.1M
C606 100MF 25V
CR606 RD6.2JB
R613 1K 1/2

R603 1K
Q601 2SK30A GR
R601 Δ8.2K
RV601 1KB
R602 Δ1K
CR601 1588
CR602 HZ6B1L
C601 470 MF 25V
C605 470MF 25V

CR607 S1VB20

A556

R501~506 C 501~507 U501
CR501~508 J501
R 601~620 C 601~605 Q601~604
RV 601~605 CR601~607 608 U601, 602

KIKUSUI ELECTRONICS CORPORATION

TITLE MODEL PLZ 72W
A555, 556
CIRCUIT DIAGRAM

CODE NO.

DRAWING NO. 317956

8203 IKSK15

DATE	APP. BY	REV. BY	CONTENTS
△59.12.13	川上	山下	CR606 12段, R606 470, R510 27K に変更
△59.10.18	川上	山下	CR603 定格変更
58.10.25	川上	山下	

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