

KENWOOD

REGULATED DC POWER SUPPLY

PWR18-1T

PWR18-1.8Q

INSTRUCTION MANUAL
(Part of Power Supply Function)

KENWOOD CORPORATION

FCC WARNING:

This equipment may generate or use radio frequency energy. Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved in the instruction manual. The user could lose the authority to operate this equipment if an unauthorized change or modification is made.

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.*
- Increase the separation between the equipment and receiver.*
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- Consult the dealer or an experienced radio/TV technician for help.*

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1. OUTLINE

The PWR series CV/CC power supply units are the first in their class with built-in microcomputers, making their multi-functional capabilities second to none in the market. Their dual tracking function is helping the series achieve the highest of reliability. Moreover, their multi-output is earning them a several-fold lead over conventional single-output power supply units, making the PWR series most ideal for research and as a power source for various systems. The PWR series is also compatible with GP-IB, at time of system connection, Master Control, and various other remote control. The PWR series fully satisfies the current demand for a powerful and multi-functional power supply unit for automatic measurement systems and simulation tests.

Guidelines on Instruction Manual Usage

The PWR series instruction manual comes in two sets, one for the power supply and the other for remote control.

This instruction manual is for the former. Refer to the other manual for remote control operation.

2. FEATURES

- * Dual tracking function mode: Enables output voltage and current (negative and positive) to be changed at the same rate and same time.
- * Seven-segment LED display function (red): Enables voltage and current digital values to be displayed at the same time. This function allows the user to easily view the actual output voltage and current levels and the values previously set.
- * Preset function: Allows the user to preset up to three pairs of voltage and current most frequently used. This enables the quick target selection.
- * Delay function: When using a large output power source, sudden damage can occur to the load when multiple outputs are turned ON or OFF simultaneously. To prevent this damage, an output scheduled to come ON will be delayed for a specified amount of time; i.e. they will be temporarily left OFF during the delay time.
- * Excellent man-machine interface: One-touch key switches provided for setting operational conditions. All the variables can be entered through the "one-dial control" of the rotary encoder. In addition, the desired output voltage and current values can be specified precisely in 10mV and 10mA unit.
- * Key lock function: Forces all the values previously set to be fixed. This prevents the current values from being altered by someone else while the user is "out".
- * Protect function: Prevents unexpected voltage and current from being output to an external application board. This function is helpful when the preset key, variable key, and tracking key are pressed in the output operation mode.
- * Safety mechanism design: Well-designed heat sink provided for preventing intra-unit temperature from becoming high too much. No fan is used for cooling. As a result, the internal functional blocks are not degraded due to noises, vibration and dust.
- * Backup function: Allows the values previously set to be kept in the back-up memory. That is, even if the regulated power supplies are turned off, the current values are saved to the back-up memory. There is no need for the user to enter data each time when the system is turned on.
- * Apart from the features described so far, the PWR has another special feature which is the capability to control each function by remote control.
Refer to the instruction manual for remote control for details.

3. SPECIFICATIONS

Model	PWR18-1.8Q				PWR18-1T	
OUTPUT VOLTAGE						
Output voltage	0 to +18V/0 to -18V	0 to +8V	0 to -6V	0 to +18V/0 to -18V	0 to +6V	
Setting resolution	10mV					
Max. output voltage	+18V/-18V	+8.0V	-6.0V	+18V/-18V	+6.0V	
Dual tracking	0 to $\pm 18V$				0 to $\pm 18V$	
Tracking deviation	$\pm (1\% + 40mV)$ of rated voltage				$\pm (1\% + 40mV)$ of rated voltage	
OUTPUT CURRENT						
Output current	0 to +1.8A/0 to -1.8A	0 to +2A	0 to -1A	0 to +1A/0 to -1A	0 to +5A	
Setting resolution	10mA					
Max. output current	+1.8A/-1.8A	+2.0A	-1.0A	+1A/-1A	+5.0A	
Dual tracking	0 to $\pm 1.8A$				0 to $\pm 1A$	
Tracking deviation	$(2\% + 40mA)$ of rated current				$(2\% + 40mA)$ of rated current	
CONSTANT VOLTAGE CHARACTERISTICS						
Input fluctuation (for surge of AC $\pm 10\%$)	1mV			1mV	2mV	
Load fluctuation (for surge of 0 to 100%)	3mV			2mV	5mV	
Ripple/noise rms (10Hz to 1MHz)	0.5mV rms			0.5mV rms		

Model	PWR18-1.8Q	PWR18-1T	
Ripple peak (p-p)	2.8mV p-p	2.8mV p-p	5.6mV p-p
Transient response	50 μ s Typical	50 μ s Typical	100 μ s Typical
Temperature coefficient	100ppm/ $^{\circ}$ C Typical		
CONSTANT CURRENT CHARACTERISTICS			
Input fluctuation (for surge of AC \pm 10%)	2mA Typical	2mA Typical	4mA Typical
Load fluctuation (for surge of 0 to 100%)	10mA Typical	10mA Typical	20mA Typical
Ripple/noise rms (10Hz to 1MHz)	2mA rms Typical	2mA rms Typical	5mA rms Typical
Ripple peak (p-p)	5.6mA p-p Typical	5.6mA p-p Typical	10mA p-p Typical
Temperature coefficient	300ppm/ $^{\circ}$ C Typical		
VOLTMETER			
Display (3-1/2 digit LED)	max. 19.99V, fixed range red LED		
Accuracy (output "ON")	\pm (0.5% rdg + 2 digit) (23 $^{\circ}$ C \pm 5 $^{\circ}$ C, less than 80% RH)		
AMPMETER			
Display (3 digit LED)	max. 9.99A, fixed range red LED		
\pm Accuracy (output "ON")	(1.0% rdg + 2 digit) 23 $^{\circ}$ C \pm 5 $^{\circ}$ C, less than 80% RH		

Model	PWR18-1.8Q	PWR18-1T
FUNCTIONS		
Output ON/OFF	ON/OFF switch. However, output cannot be ON when MEMORY ON. Red LED lights up when ON.	
Output protect ON/OFF	Disables the output of unexpected voltage and current in the output mode. This 'PROTECT' function becomes active when a different value is set by one of the PRESET, VARIABLE and TRACKING keys in the output mode. (ON→Red LED active)	
Preset (1,2,3)	3 voltages or currents can be preset as desired. Preset values can be easily checked. Green LED lights up when ON.	
Memory	Several voltage and current presets can be stored. Red LED lights when ON.	
Key Lock	Locks all functions as set. All controls except POWER are disabled. Red LED.	
Delay	ON/OFF DELAY of $\pm 18V$ and $+8V/-6V$ output. Green LED lights up when ON.	ON/OFF DELAY of $\pm 18V$ and $+6V$ output. Green LED lights up when ON.
V/A	Several voltages and currents can be set. Green LED.	
Tracking and V/A display selection	$\pm 18V$ tracking, $+18V$, $-18V$, $+8V$, $-6V$	$\pm 18V$ tracking, $+18V$, $-18V$, $+6V$
OUTPUT		
COM	$\pm 18V +8V$, $-6V$ COM common	$\pm 18V$ COM common, $+6V$ single
Polarity	COM, positive or negative ground possible	
Output terminals	+ (red), - (white), COM (blue), GND (black)	
Ground proof voltage	$\pm 250V$ DC	

Model	PWR18-1.8Q	PWR18-1T
SERIAL OUTPUT	0 to 36V	0 to 36V + 0 to 6V
OPERATION CONDITIONS		
Rated temperature/humidity range	0 to 40°C, 10 to 85% RH	
Operation temperature/humidity range	0 to 40°C, 10 to 85% RH	
Storage temperature/humidity range	- 20 to 65°C, 10 to 85% RH	
Cooling mechanism	Natural convection	
POWER CONSUMPTION		
VA/W (at AC 100V)	approx. 240VA/213W	approx. 210VA/176W
INPUT VOLTAGE		
Voltage, Frequency	AC 100V ± 10% 120V/220V/240V ± 10% (max. 250V), 50/60Hz Internal switching possible.	
DIMENSIONS AND WEIGHT		
Dimensions	width: 138mm height: 147mm depth: 372mm	
Max. dimensions	width: 143mm height: 167mm depth: 392mm	
Weight	approx. 8.2kg	
Accessory items	1 instruction manual 1 power supply cord 2 fuses 1 moduler cable (for remote control)	

■ Circuit and ratings are subject to change without notice due to developments in technology.

4. PRECAUTIONS FOR USE

Please keep the following in mind when reading and using this operation manual.

This manual was originally intended to be used for operating both the PWR18-1T and PWR18-1.8Q; however, the actual writing of the manual was based mainly on the 1.8Q. Even though most of the procedures and directions are the same for both models, there are points of dissimilarity. These points will be set off by parenthetical [] marks throughout the text.

1) confirming the supply voltage

- * Use the unit within the specified range.
The unit's rated voltage is single-phase, 100/120/220/240 V AC $\pm 10\%$ (max. 250 V) at 50/60 Hz.
- * The rated voltage is written on the name plate located under the AC input terminal on the rear panel.
- * See the Maintenance section for information on how to change the supply voltage.

2) connection of power cord

Be user to plug the provided power cord deeply and firmly into the AC input terminal.

3) Precautions for connection of output terminals

- * Because this is a dual output machine that puts out positive/negative voltages and currents, do not use the provided shoring bar or other device to short the CM terminal with the positive and negative terminals, or the positive and

negative terminals with each other. If a short is made, use the machine after setting the output voltage to rather a low level. If it is high, the internal circuits may be damaged. Keep it in mind.

- * This is a floating type power supply. For normal use, the provided shorting bar to connect the GND and COM terminals. In addition, when connecting the short bar between the COM and GND terminals, or when removing it, be sure to put the OUTPUT switch to "OFF".

4) Set-up Environment

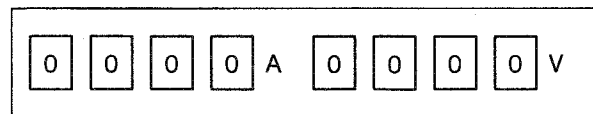
- * Be sure to use the machine within the specified ambient temperature range of 0 to 40 deg C.
- * Because the unit is cooled by natural convection, do not place objects on top, place the unit under any heat-emitting device, or use multiple units in stacked configuration. Addition, place the unit in as well ventilated a place as possible.
- * During use, the heat sink in the rear panel may get hot. Ensure good ventilation and do not place heat-susceptible objects nearby.

5) Remarks regarding turning on the power supply

- * No data is displayed on the display panel and the LED display remains inactive for about three seconds after this system is turned on. Note that the system is not operating abnormally. Wait until some data is displayed on the display panel.

- * In the case of normal switch-on when the backup condenser is charging, the voltage and currents displayed will all be "0" (See Figure 1-a). Then, after 5 seconds, normal operation will begin.
- * Because the unit uses a condenser as the memory set back-up power supply, when first turning the power supply on, or when turning it on for the first time in a long time (more than 1 week), all of the voltage display will read "0" (See Figure 1-a). This is not a malfunction, please wait. While the machine is in this state, all control switches will be non-functional.
- * If the system is turned off while the data '0000' is displayed on the display panel, the content of the backup memory may be destroyed. It may cause an error. Keep it in mind. If the system is turned off due to operational errors or some other unavoidable errors (for example, power failure), perform the operations discussed in Note 2 on page 20. The system will be initialized.

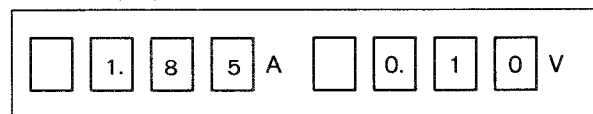
(Display data of the after power is supplied)



a

↓
five to ten seconds

(Initial display data)



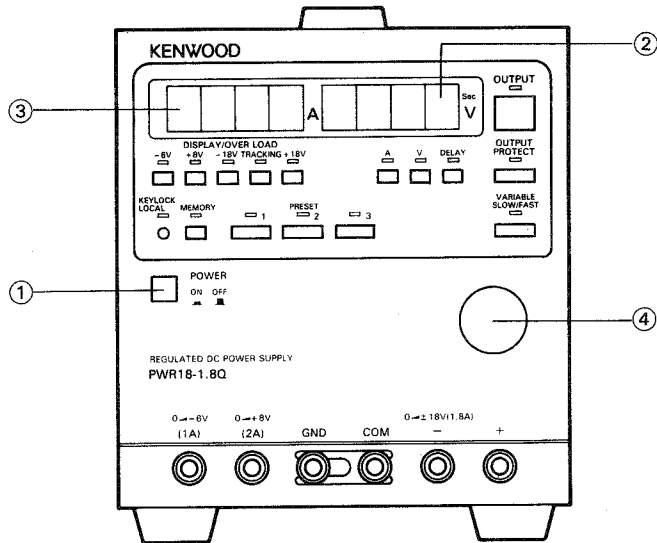
b

- * [The above diagram is for the PWR18-1.8Q only. The displayed value for the PWR18-1T will be 1.04A, 0.10V in this case.]

Fig. 1

5. PANEL EXPLANATION

5-1 Front Panel



* Illustration is PWR18-1.8Q

Fig. 2

① POWER ON / OFF

This is the power switch. The power is turned on when this switch is pressed. The power is turned off when this switch is pressed again.

Nothing is displayed on the panel for approximately three seconds after the power is turned on.

② Voltmeter

This indicates the positive (+) and negative (-) setting values for the voltage and the output voltage.

[The last-digital data may not be stable due to display resolution. However, the output, does not fluctuate.]

* If a reverse voltage is generated 0.00 V is displayed and the display flashes.

③ Ammeter

This indicates the output current value and the setting value of the positive (+) and negative (-) output current.

④ Rotary Encoder (voltage, current, delay set knob)

This is rotary encoder-type knob for setting the positive/negative voltage, current limit, and delay time. The output voltage value can be set or changed when the V.LED ⑤ is lit, and the current limit value can be set or changed when the A.LED ⑥. The delay value can be set when the DELAY.LED is lit. The respective values increase as the knob is turned clockwise.

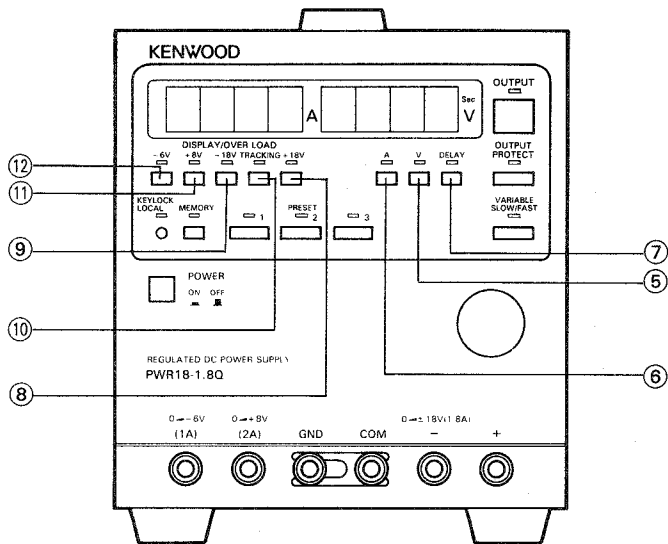


Fig. 3

⑤ **V-Key / V-LED (Green)**

This key sets the output voltage value and the LED lights to indicate when the output voltage value can be set. Press this key to set the output voltage value. The V-LED lights when this key is pressed and the output voltage that is indicated on the voltmeter ② can be varied or set by the rotary encoder ④. When this key is pressed again, the V-LED goes off and the output voltage value cannot be varied by the rotary encoder ④.

⑥ **A-Key / A-LED (Green)**

This key sets the current limit value and the LED indicates when the current limit value is set. The A-LED lights when this key is pressed and the current limit value that is indicated on the voltmeter ② can be varied or set by the rotary encoder ④.

When this key is pressed again, the A-LED goes off and the current limit value cannot be varied by the rotary encoder ④.

⑦ **DELAY Key / DELAY LED (Green)**

Press this key to light the DELAY LED and set with the rotary encoder the ON/OFF time intervals between tracking output ([+ 1.8V/+ 1.8A for PWR18-1.8Q; + 18V/+ 2A for PWR18-1T]) and other output ([+ 8V/+ 2A for PWR18-1.8Q; + 6V/+ 5A for PWR18-1T]).

Press this key again to extinguish the DELAY LED so that the delay time cannot be altered by the rotary encoder. For more details see section 6-5 in the chapter on operation procedures.

⑧ + 18V Key / OVERLOAD LED (Green)

This key sets the output voltage or the positive (+) current limit value and the LED indicates when this setting is possible.

The positive (+) output voltage and current value or the setting value are displayed and the + 18V LED lights when this key is pressed.

Press this key and set the value with the rotary encoder ④ to set the output voltage or the positive (+) current limit value.

If the output is overloaded (Constant current operation), the OVERLOAD (+ 18V) LED flashes to indicate a malfunction warning.

The LED goes off when the + 18V key is pressed again.

⑨ - 18V Key / OVERLOAD LED (Green)

This key sets the output voltage or the negative (-) current limit value and the LED indicates when this setting is possible.

The negative output voltage and current value or the setting value are displayed and the - 18V LED lights when this key is pressed.

Press this key and set the value with the V-A value setting knob ④ to set output voltage or the negative (-) current limit value.

If the output is overloaded (Constant current operation), the OVERLOAD (- 18V) LED flashes to indicate a malfunction warning.

The LED goes off when the - 18V key is pressed again.

⑩ TRACKING Key / TRACKING LED (Red)

This key sets the output (the positive and negative voltage and current values to the same value) in the tracking mode. The LED lights to indicate that this mode is set.

When this key is pressed, the setting values of the positive (+) and negative (-) output voltage and current limit are set to the same absolute value and the TRACKING LED lights.

The currently indicated value (selected by either the + 18V key ⑧ or the - 18V key ⑨) has priority for the tracking value and the output value that is not displayed is set to correspond to this value.

When this key is pressed again, the LED goes off and the tracking status is canceled. The setting value remains at the same value as when the tracking is performed and is not reset to the original value.

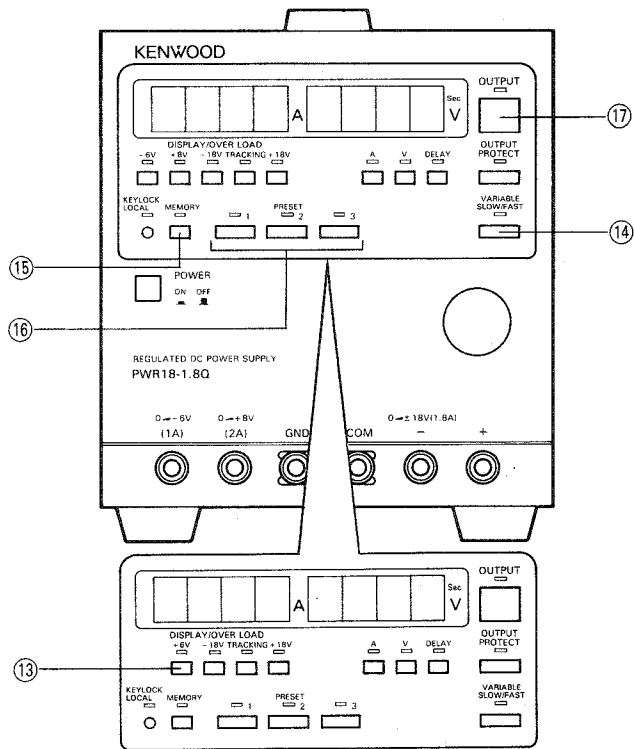
⑪ + 8V Key / OVERLOAD LED (Green)

[This key has been added to the PWR18-1.8Q only.] When this key is pressed the + 8V LED will light up and the values and/or settings for + 8V output voltage and electrical current limits will be displayed.

When you want + 8V of output, press this key and use the rotary encoder to set the values for the output voltage and electrical current limits. If an output overload occurs (at constant current operation), the + 8V LED will begin flashing.

⑫ - 6V Key / OVERLOAD LED (Green)

[This key has been added to the PWR18-1.8Q only.] When this key is pressed the - 6V LED will light up and the values



* Illustration is PWR18-1T

Fig. 4

and/or settings for $-6V$ output voltage and electrical current limits will be displayed.

When you want $-6V$ of output, press this key and use the rotary encoder to set the values for the output voltage and electrical current limits. If an output overload occurs (at constant current operation), the $-6V$ LED will begin flashing.

⑬ **+6V Key / OVERLOAD LED (Green)**

[This key has been added to the PWR18-1T only.] When this key is pressed the $+6V$ LED will light up and the values and/or settings for $+6V$ output voltage and electrical current limits will be displayed.

When you want $+6V$ of output, press this key and use the rotary encoder to set the values for the output voltage and electrical current limits. If an output overload occurs (at constant current operation), the $+6V$ LED will begin flashing.

⑭ **VARIABLE Key/VARIABLE LED (Green/Orange)**

This key is pressed to change the output setting. When the key is pressed, the LED lights up to indicate that the machine is in a state where the voltage setting can be varied. When the LED is lit, the voltage can be changed by via the rotary encoder knob.

This key works in coordination with the PRESET key ⑯. If either the MEMORY key ⑮ or one of the PRESET keys is pressed, the VARIABLE LED goes off and variation of the voltage output becomes disabled.

This key can also be used to control the adjustment speed when changing the voltage via the rotary encoder. When

the machine is in the VARIABLE mode and the green LED is lit up, the variation speed is set to "SLOW". If the key is pressed once more, the orange LED lights up and the variation speed switches to "FAST". If the key is pressed yet again, the green LED lights again and the variation speed reverts to "SLOW".

⑮ MEMORY Key / MEMORY LED (Red)

The MEMORY function is used to store the previous setting values for output voltage and current and delay time that are stored in the PRESET function of the main unit. This key and LED are used to set and indicate the preparation standby mode when the setting values in the PRESET keys ⑮ are recorded.

If this key is pressed when the OUTPUT key ⑰ is set OFF, the MEMORY LED lights to indicate that the preset operation can be performed.

The setting value is stored for the selected key number by setting the voltage and current setting value by the V-key ⑤, A-key ⑥ or rotary encoder ④ and then selecting any one of the PRESET keys (1, 2, and 3). If this key is pressed again the MEMORY LED goes off to indicate that the preset status is canceled.

The condition that was determined by the previous value setting is restored if this key is pressed when the MEMORY LED lights (before the PRESET key is selected).

If this key is pressed again when the MEMORY LED is lit, the stored value returns to the initial setting that existed before the key was pressed the first time. If the VARIABLE key ⑭ is pressed while the MEMORY LED is lit, the

VARIABLE LED lights up for about 3 seconds, the ADDRESS NO. used in the REMOTE mode is displayed on the voltmeter ② and ammeter ③ displays. For details, see Sections 6 of this manual ("Operation Procedure"), or the separate Remote Control Instruction Manual.

⑯ PRESET (1, 2, 3) Key / PRESET LED (1, 2, 3) (Green)

The output condition settings are stored in a key before operation and the LED lights in the corresponding keys when the settings are read.

Three types of output conditions within the standard range can be set and stored as desired.

These keys have two operations method. If the PRESET 1 key is pressed, the PRESET 1 LED lights. The following operations can be performed.

- (1) The setting conditions can be stored (only when MEMORY LED ⑮ lights).
- (2) The output is performed according to the stored setting conditions. (with the OUTPUT LED ⑰ on)

The operation and LED function are the same for PRESET 2 and PRESET 3.

⑰ OUTPUT Key / OUTPUT LED (Red)

The OUTPUT LED lights when the OUTPUT key is pressed and the positive and negative voltage and current are output simultaneously. The voltmeter and ammeter indicate the output values at this time. If the output key is pressed when the OUTPUT LED lights, the OUTPUT LED goes off and the positive and negative output stops simultaneously.

When the system is powered on, the OUTPUT LED does not light. That is, the system is initialized to the output OFF mode.

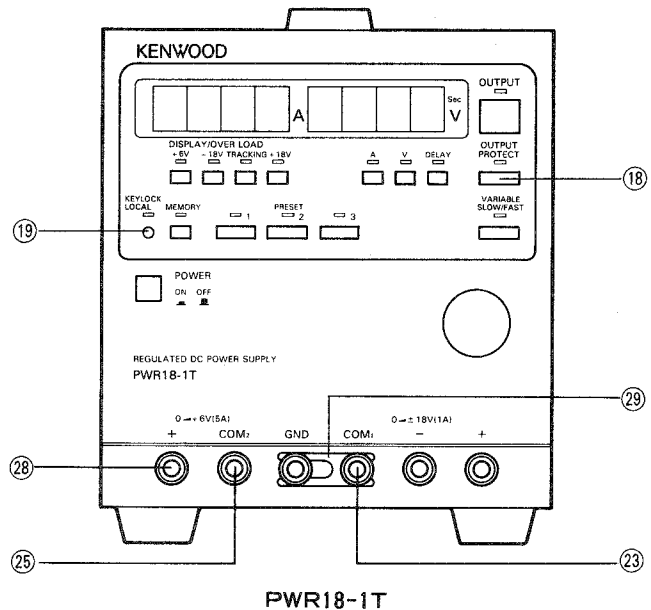
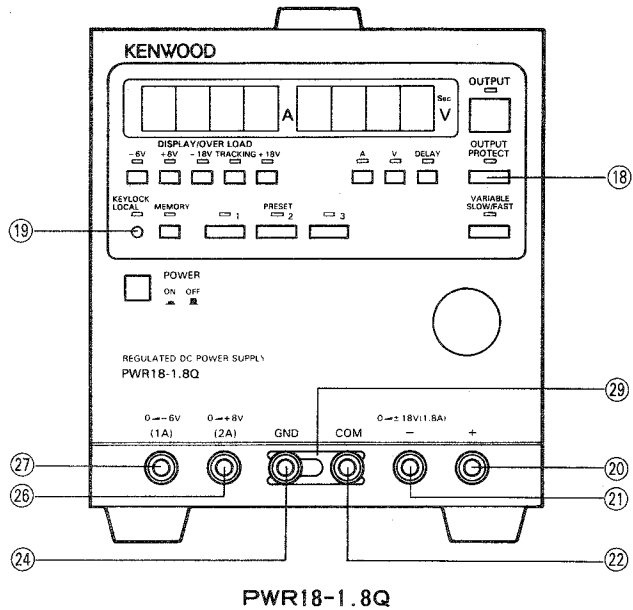


Fig. 5

⑱ OUTPUT PROTECT Key / OUTPUT PROTECT LED (Red)

This key sets the OUTPUT PROTECT function ON and OFF and the LED indicates the function status.

The OUTPUT PROTECT status is set as the initial setting for the pulse surface and the LED lights when the power is first applied.

If this key is pressed when the OUTPUT PROTECT function is set, the OUTPUT PROTECT function is canceled and the OUTPUT PROTECT LED also goes off.

The OUTPUT PROTECT function should be set and the LED should light during normal operation.

Refer to the section "Operating Procedure" for a detailed explanation of the setting procedures.

**⑲ KEY LOCK Switch / KEY LOCK LED (Red)
LOCAL Key / LOCAL LED (Green/Orange)**

This key turns the KEY LOCK setting ON and OFF and the LED lights to indicate the function status.

The KEY LOCK LED is OFF as the initial default setting after the power is first applied. The LED lights when the KEY LOCK switch is turned ON.

When the KEY LOCK switch is pressed again, the LED goes off to indicate that the KEY LOCK status is set OFF.

When the KEY LOCK function is set ON, all other key switch operations, except for power switch, cannot be performed. This LED lights up green when the machine address is set to "0", and lights up orange for any machine address other than "0" (REMOTE mode). Press this key to change the machine from the REMOTE mode to the LOCAL mode. If this key is pressed when the machine is the REMOTE

mode, the LED goes off and the machine switches to the LOCAL mode. Remember that in the REMOTE mode, operation of all keys other than this one are inoperable, and input from the rotary encoder is not accepted. For details, see Sections 6 of this manual ("Operation Procedure"), or the separate Remote Control Instruction Manual.

The ON and OFF setting for this switch is performed by pressing and insulated round shaft 2 to 3 mm in diameter in the round hole in the front panel.

⑳ + 18V Output Terminal

This terminal is used to output +18V/+1.8A ([+18V/+1A in PWR18-1T]) for the COM [COM1 in PWR18-1T] terminal.

㉑ - 18V Output Terminal

This terminal is used to output -18V/-1.8A ([-18V/-1A in PWR18-1T]) for the COM [COM1 in PWR18-1T] terminal.

㉒ COM Terminal (Added only to PWR18-1.8Q)

The common terminal which is used for $\pm 18V/\pm 1.8A$ output.

㉓ COM1 Terminal (Added only to PWR18-1T)

The common terminal which is used for $\pm 18V/\pm 1.8A$ output.

㉔ GND Terminal

This ground terminal is connected to the main chassis. During normal operational use it should be connecting to the COM (COM1 or COM2 in PWR18-1T) terminal via the short bar.

㉕ COM2 Terminal (Added to PWR18-1T only)

The common terminal which is used for +6V/+5A output.

5-2 Rear panel

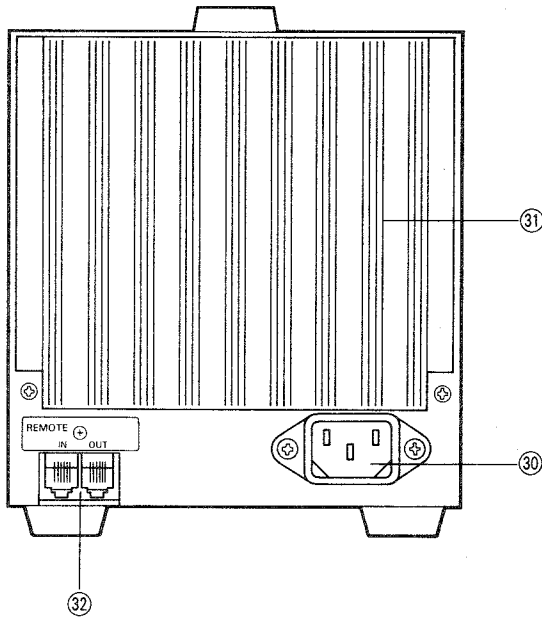


Fig. 6

- ②⑥ **+8V Output Terminal (Added to PWR18-1.8Q only)**
This terminal is used to output +8V/+2A for the COM Terminal.
- ②⑦ **-6V Output Terminal (Added to PWR18-1.8Q only)**
This terminal is used to output -6V/-1A for the COM Terminal.
- ②⑧ **+6V Output Terminal (Added to PWR18-1T only)**
This terminal is used to output +6V/+5A for the COM2 Terminal.
- ②⑨ **Short Bar**
This bar connects the COM GND terminals.
- ③⑩ **Power Input Connector**
The AC current is input by this connector. Always use the accessory power cord for connection to this terminal.
- ③① **Heat Sink**
This is a radiator for the transistors. Be careful not to touch it as it can be extremely hot from dissipating the heat from the components.
- ③② **Remote Connector**
The connector used for input or output of remote signals when the machine is used with the remote control mode. Be sure to use the connecting chord provided with the machine. For details, please see Section 6 ("Operation Procedure"), or the separate Remote Control Instruction Manual.

6. OPERATION PROCEDURE

Make sure that the power source provides the rated voltage, before connecting the power cord (attached to the unit) to the power input connector which is installed on the back of the unit.

When connecting a load to the output terminal, make sure in advance that the OUTPUT KEY ⑰ is set OFF (the OUTPUT LED is not lit).

Initial parameters upon the start-up of the unit

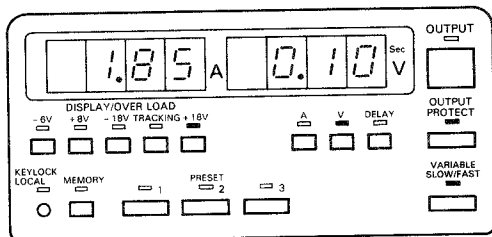


Fig. 7

The following are the initial settings when the unit is powered for the first time after purchase (or after it has not been used for a long period of time.)

1. + 18V LED ⑧ Lights up
2. V LED ⑤ Lights up
3. OUTPUT LED ⑰ Turn off
4. VARIABLE LED ⑭ Lights up (Green)
5. OUTPUT PROTECT LED ⑱ Lights up
6. The initial settings of the voltmeter ②, the ammeter ③, and the PRESET KEYS (1,2,3) ⑩ are:

Display settings for the positive (+) output

PWR 18-1T

	1	.	0	4	A		0	.	1	0	V
--	---	---	---	---	---	--	---	---	---	---	---

PWR 18-1.8Q

	1	.	8	5	A		0	.	1	0	V
--	---	---	---	---	---	--	---	---	---	---	---

Display settings for the negative (-) output

PWR 18-1T

-	1	.	0	4	A	-	0	.	1	0	V
---	---	---	---	---	---	---	---	---	---	---	---

PWR 18-1.8Q

-	1	.	8	5	A	-	0	.	1	0	V
---	---	---	---	---	---	---	---	---	---	---	---

7. Other output keys should be initial setting as shown below:

PWR18-1.8Q: +8V key; 2.06A/0.10V
 -6V key; -1.04A/0.10V
 PWR18-1T : +6V key; 5.12A/0.10V

8. Initial DELAY Setting:
DELAY TIME: 0.00 s

Note 1

After the first use of the unit, the settings from the previous operation (just before the power shut off) are displayed. Note that the OUTPUT mode is set to OFF and the OUTPUT PROTECT mode is set to ON.

Note 2

Upon turning on the power switch, if the VARIABLE KEY ⑩ is kept pressed until the displayed value of each of the voltmeter and ammeter becomes "0000", the settings of the panel will return to the said initial settings, and the data stored in the PRESET KEYS be cleared.

[Caution] : If the system is turned off while the data '0000' is displayed on the display pannel. The content of the backup memory may be destroyed. It may cause an error. Keep it in mind. If the system is turned off due to operational errors or some other unavoidable errors (for example, power failure), perform the operations discussed in Note 2 on. The system will be initialized.

Setting by the Rotary Encoder

- * Every set value can be varied by using the V/A value setting knob of the rotary encoding system. The set value increases if the knob is turned clockwise. The set value decreases if the knob is turned counterclockwise.
- * When adjusting settings using the Rotary Encoder, the amount by which the target parameter changes per increment of rotation will vary depending on how quickly the knob is rotated.
 - 1) When the VARIABLE LED is lit up green ("SLOW" mode) and the Rotary Encoder knob is rotated slowly, the voltage, current, and delay time settings will change in increments of 10mV, 10mA, and 10ms, respectively, per click of the knob. If the knob is turned quickly, the settings will change in increments of about 2V, 1.8A, and 2s, respectively (about 2V, 1A, and 2s, respectively, for the 18-1T model).
 - 2) When the VARIABLE LED is lit up orange ("FAST" mode) and the Rotary Encoder knob is rotated slowly, the voltage, current, and delay time settings will change by the same increments as for the "SLOW" mode (i.e., 10mV, 10mA, 10ms). However, if the knob is turned quickly in the "FAST" mode, the settings will change in increments of about double those in the "SLOW" mode (about 4V, 3.6A, and 4s, respectively). Beyond these values, the increments will increase no further no matter how quickly the knob is rotated.

- * If the positive or negative output voltage level is set to + or - 50 mV, this new value will be stabilized in a few seconds. The same temporary value is set when a new value is set using the PRESET feature.
- * One click on the rotary encoder may force 2-digit voltage and current display data to change at the same time or to remain unchanged.

When turning the Rotary Encoder, do not apply an excessive force to its shaft, as this may cause damage. The Rotary encoder is equipped with a mechanical contact and extended use requires the current rotary encoder to be replaced with a new one. Call the local service representative if this occurs.

6-1 Using as a positive (+) stabilized power supply

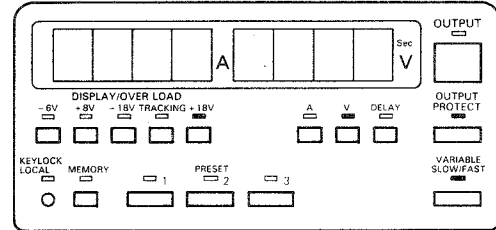


Fig. 8

- 1) Set the LEDs as shown in the Figure 8. (Make sure that the OUTPUT LED is not lit.)
 - 2) Turn the Rotary Encoder to set an arbitrary voltage value.
 - 3) Press the A KEY (6) and make sure that the A LED lights up.
 - 4) Turn the Rotary Encoder to set an arbitrary current limit value.
 - 5) Press the OUTPUT KEY (17) to obtain the output value entered from the positive (+) output terminal.
- * Follow the same setting procedure when the +8V KEY is selected in the PWR18-1.8Q and when the +6V KEY is selected in the PWR18-1T.
- The output is obtained from terminal (26) for the PWR18-1.8Q and from terminal (28) for the PWR18-1T.

6-2 Using as a negative (-) output as the stabilized power supply

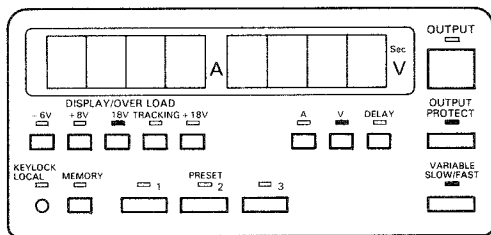


Fig. 9

- 1) Set the LEDs as shown in the Figure 9. (Make sure that the OUTPUT LED is not lit.)
 - 2) Turn the Rotary Encoder to set an arbitrary voltage value.
 - 3) Press the A KEY ⑥ and make sure that the A LED lights up.
 - 4) Turn the Rotary Encoder to set an arbitrary current limit value.
 - 5) Press the OUTPUT KEY ⑰ to obtain the output value entered from the negative (+) output terminal.
- * Follow the same setting procedure when the -6V KEY is selected in the PWR18-1.8Q.
The output is obtained from the -6V output terminal.

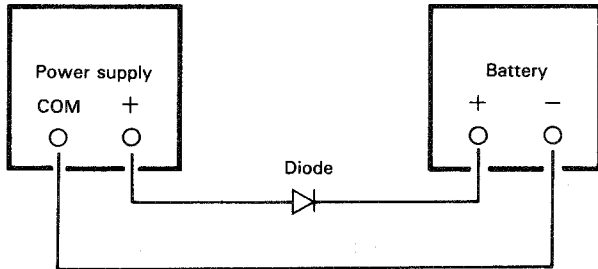
If the OUTPUT KEY ⑰ is pressed (ON), both positive and negative output terminals supply a voltage and a current.

If the load short-circuits, or if the set current limit value is reached, the circuit becomes overloaded and the output voltage drops. The unit may be used a constant-current power source in this overloaded condition.

Note that the current limiter may sometimes deviate several digits from the specified current limit value. If the current limiter is used within the smaller range of error, connect each output pin to the ground level and place the system in the overload status, and then use this products after setting a desired current limiter value.

If rather a large-capacitance load is connected to this product, it will take some seconds until the stable voltage level is reached. Keep it in mind.

The positive, negative pins and the COM pin of this product have a capacitor of 100 micro farad. This product has an internal circuit for the discharge. This internal circuit becomes active when the output mode is set to OFF. This means that the diodes in serial with a load are required to prevent the discharge if the products is used as a battery charger or a memory backup battery.



6-3 Tracking Power Supply Procedure

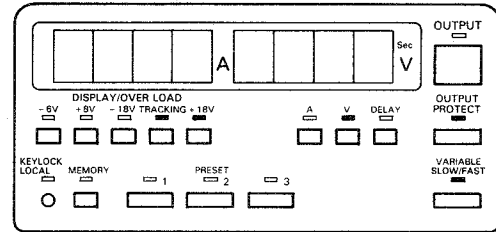


Fig. 10

- 1) Set the LEDs as shown is Figure 10.
(Be sure that the OUTPUT LED ⑰ is not lit.)
Figure 10 indicates the case where positive voltage level is used.
- 2) Turn the Rotary Encoder to set an arbitrary positive voltage value.
- 3) Press the A KEY ⑥ and make sure that the A LED lights up.
- 4) Turn the Rotary Encoder to set an arbitrary positive current value.
- 5) If the - 18V KEY is pressed, the display of each of the volt-meter and the ammeter allows the user to confirm that the negative value is the same as the positive.
- 6) Press the OUTPUT KEY ⑰ to obtain the output value entered from the positive (+), or negative (-), output terminal.
- 7) If the Rotary Encoder is turned in the state of ⑥ above, the negative values change. Press the + 18V KEY to make sure that the positive values are changing alike.

The unit is tracking while the TRACKING LED ⑩ is lit. The absolute value of both set voltage value and set current limit value are identical, for both positive and negative outputs.

The unit does not track when the TRACKING LED ⑩ is not lit. If the TRACKING KEY ⑩ is pressed, the TRACKING LED lights up and tracking starts, and the set voltage and current limit values attain the same values as indicated by the voltmeter and the ammeter, respectively. If the settings of voltage and current need to be changed, press the TRACKING KEY again to cancel the tracking and enter a new positive or negative value for each of the voltage and current.

for new voltage and current values.

6-4 PRESET feature

- (1) The PRESET feature is used to store the actually value setting (displayed value) in one of the PRESET (1, 2, 3) KEYS ⑯.

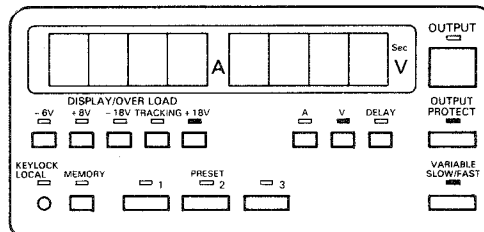


Fig. 11

- 1) Set the LEDs as indicated in Figure 11. Always make sure that the OUTPUT LED ⑰ is not lit.
- 2) Set a positive voltage value by the Rotary Encoder.
- 3) Press the A KEY ⑥ and turn the Rotary Encoder to set a positive current limit value.
- 4) Press - 18V KEY ⑧ and turn the Rotary Encoder to set a negative current limit value.
- 5) Press the V KEY ⑤ and turn the Rotary encoder to set a negative voltage value.
- 6) Press the MEMORY KEY ⑮ and confirm that the VARIABLE LED ⑭ goes off.
- 7) If one of the PRESET KEYS (1,2,3) ⑯ is pressed, the MEMORY LED ⑮ goes off and the LED of the selected

PRESET KEY lights up. An arbitrarily entered value is stored in the selected PRESET key at this time.

- 8) Perform the same procedure to store an arbitrary setting value in each of the other PRESET KEYS.

Any setting value stored in one of the PRESET KEYS ⑯ cannot be altered while the OUTPUT LED ⑰ is lit (during the output operation). The setting value can be changed during the output operation if the VARIABLE LED ⑭ is lit.

(2) To change the set value stored in the PRESET KEY:

- 1) Press any one of the PRESET key (1, 2 and 3) to store a new value for it when the system is placed in the state described in 1) of the previous section.
- 2) Press the MEMORY key.
- 3) Set a new voltage/current value according to the procedures described in 2) to 5) of the previous section.
- 4) Press another PRESET key store a new value for it again.
- 5) To stop setting a new value halfway, press the MEMORY key again before pressing the PRESET key as described in 4). In this case, the MEMORY LED is turned off and the previous status (positive, negative output, values and each LED status) before the MEMORY key is pressed as described in 2) will be restored.

6-5 DELAY Procedures

(1) The DELAY Function

This function enables you to set intervals between the ON or OFF times of digital line and analog line output.

In the case of mixed digital/analog circuits, turning the outputs ON and OFF simultaneously could cause sudden damage to the connected load. The DELAY function is designed to prevent this type of effect.

When the DELAY time setting is positive, switching "ON" of the analog $\pm 18V$ output only is delayed by a specified interval (the set DELAY time), and switching "OFF" is hastened by the same interval.

When the DELAY time setting is negative, switching "ON" of the analog $\pm 18V$ output only occurs a specified interval (the set DELAY time) earlier, and switching "OFF" is delayed by the same interval.

Setting of the DELAY time is accomplished using the rotary encoder.

(2) Using the DELAY Function

- 1) First, press +18V Key ⑧ or -18V Key ⑨. Then press DELAY Key ⑦. The DELAY LED will light up, indicating that DELAY time setting is possible. When the machine is in this condition, do not pay attention to the ON/OFF settings of any other function key.
- 2) Next, set the desired DELAY time value using the rotary encoder.
Turn the rotary encoder to the right to increase the time value; turn it to the left to decrease the value. The possible delay time settings range from -10.00 to 10.00 seconds.

When setting the delay time value, either the + 18V LED ⑧ or the - 18V LED ⑨ must be lit.

The delay time can be set for output ON and/or OFF conditions.

- 3) If the OUTPUT key ⑭ is turned from "OFF" to "ON" after setting the DELAY time, for positive DELAY times, the digital output [18-1.8Q: +8V/+2A, -6V/-1A; 18-1T: +6V/+5A] will be output first. Then, after the set DELAY time has elapsed, the analog output [18-1.8Q: $\pm 18V/1.8A$; 18-1T: $\pm 18V/1A$] will be output. For negative DELAY times, the temporal relationship between the digital and analog outputs will be the exact reverse of that for positive DELAY times.

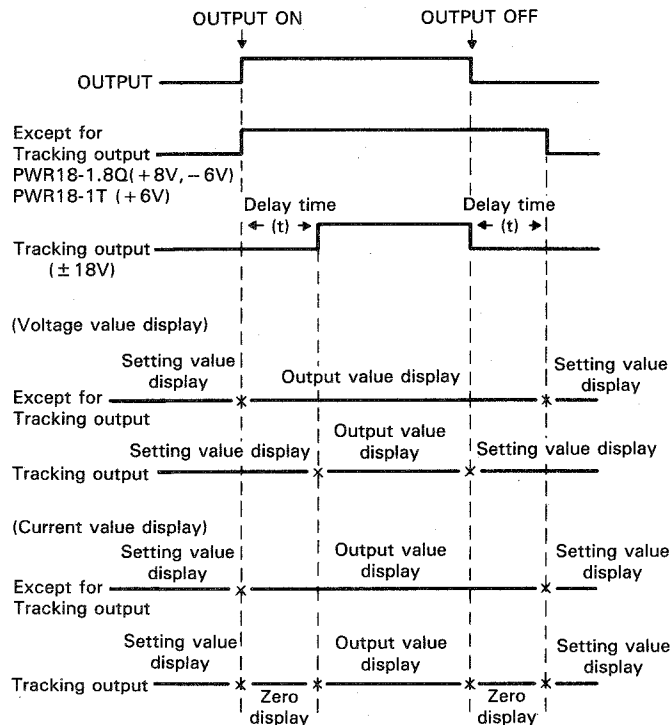
If the OUTPUT key is turned from "ON" to "OFF", for positive DELAY times, the analog output will be switched off first, and the digital output will be switched off after the set DELAY time has elapsed. For negative DELAY times, this relationship will be the exact reverse of that for positive DELAY times.

OUTPUT LED ⑭ will be flashing during the set delay time (t). If OUTPUT Key ⑭ is pressed during the delay time operation (i.e. while OUTPUT LED ⑭ is flashing), both digital and analog line output will be turned OFF, no matter what ON/OFF condition they happen to be in.

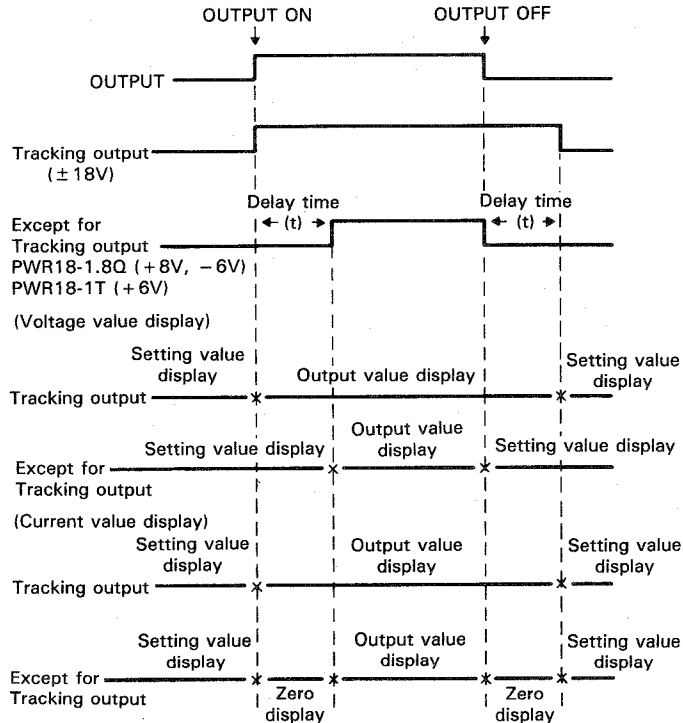
The delay time value can also be preset just like any other set value.

- 4) Display timings in DELAY operation mode.

When the DELAY settings is positive, the display timings in the DELAY operation mode are shown below:



When the DELAY settings is negative, the display timings in the DELAY operation mode are shown below:



6-6 OUTPUT PROTECT Feature

The unit is equipped with the VARIABLE KEY and PRESET KEYS (1,2,3) to change and set an output value. Each of these 4 keys can change a setting value (output value) when it is pressed. If a different key is pressed by mistake while the Unit is in operation, it is likely to erase or change loaded data (a sample circuit, etc.).

(e.g., If one of the PRESET KEYS is pressed by mistake while the Unit is used in the VARIABLE status, the setting value stored in the pressed PRESET KEY is output, which may erase the loaded data accidentally.)

The OUTPUT PROTECT feature is useful to prevent this type of accident. This feature protects the load by burning off the OUTPUT at the moment when any of the output setting keys is pressed (while the Unit is in the "OUTPUT ON" status).

If the TRACKING KEY is turned ON, the output value may also fluctuate considerably. In this case, the OUTPUT PROTECT may be turned ON to shut off the output.

- 1) Perform the following procedure to make sure the OUTPUT PROTECT feature operates correctly.

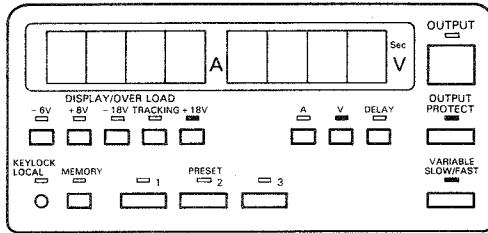


Fig. 12

- 1) Set the LEDs as shown in Figure 12. In the Figure, the VARIABLE KEY (14) is selected as an output setting key.
- 2) Press the OUTPUT KEY (17), to turn "ON" the output.
- 3) Nothing can be changed at this point, if the VARIABLE KEY is pressed.
- 4) If one of the other keys (PRESET KEY 1, 2, or 3) is pressed, the LED corresponding to the pressed key lights up, and the setting value stored in it is displayed in each of the voltmeter and the ammeter.
At the same time, the OUTPUT LED goes off, allowing the user to confirm that the output is in the OFF state.

Make sure not to turn on the OUTPUT KEY immediately after the OUTPUT PROTECT feature is started up. Otherwise, the value of the incorrectly selected output setting key will be output.

- 2) Follow the below procedure to make sure that the OUTPUT PROTECT feature is set OFF.
 - 1) Press the OUTPUT KEY as shown in Figure 11, to turn off its LED.
 - 2) Press the OUTPUT KEY to turn "ON" the output.
 - 3) Nothing can be changed at this point, if the VARIABLE KEY is pressed.
 - 4) Press one of the keys except the VARIABLE KEY and change the output value deliberately. At this time, the output will not be shut off while the OUTPUT LED is lit, and the output setting value entered in the selected key is displayed and output. The selection of another output setting key will also lead to the output of the value entered in it.

The OUTPUT PROTECT KEY can be turned ON or OFF while the output is ON.

To turn the OUTPUT PROTECT off, hold down the OUTPUT PROTECT key for longer than 2 seconds.

6-7 KEY LOCK feature

This feature is used to prevent the setting value of each function key on the panel from fluctuating, when the unit is used for an experiment for an extended period of time or for burn-in.

Use an insulated shaft of 2 to 3 in diameter to turn on or off the KEY LOCK SW.

- 1) If the KEY LOCK SWITCH ⑱ is pressed, the KEY LOCK LED lights up and any input from the Rotary Encoder or other KEYS will be rejected except for input from the power switch.
- 2) If the KEY LOCK SW is pressed again, the KEY LOCK LED goes off and the KEY LOCK status is cancelled.
- 3) If the product is turned off with the KEY LOCK mode "active", the KEY LOCK mode will be still effective after power is supplied to the product next time. That is, every key operation will be disabled in this case. Keep it in mind. If new key operations need to be performed, set the KEY LOCK switch to the OFF mode.

6-8 Rotary Encoder lock procedures

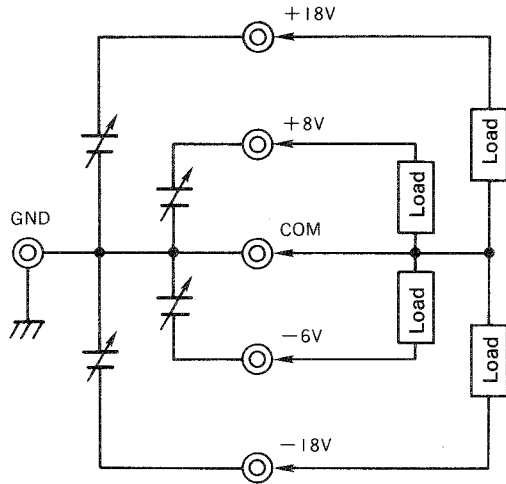
If the selected V KEY (or A KEY) is pressed, the corresponding LED goes off. The set value does not change even if the Rotary Encoder is turned, because the Rotary Encoder is locked. This feature allows the user to temporarily maintain the position (the output value) of the Rotary Encoder. If the V KEY or the A KEY is pressed again, the Rotary Encoder starts to operate and the set value can be varied.

7. APPLICATIONS

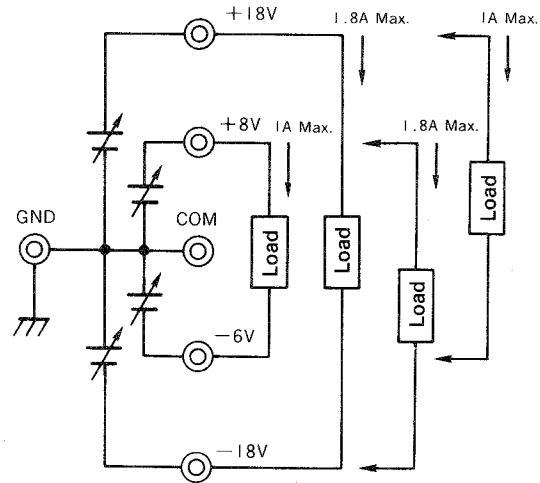
Serial Output

1) PWR18-1.8Q Serial Output Application

Usage for complimentary output



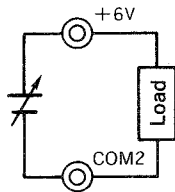
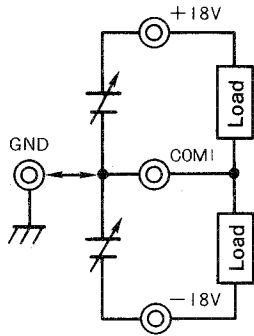
Usage for serial output



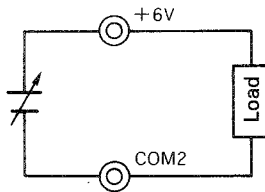
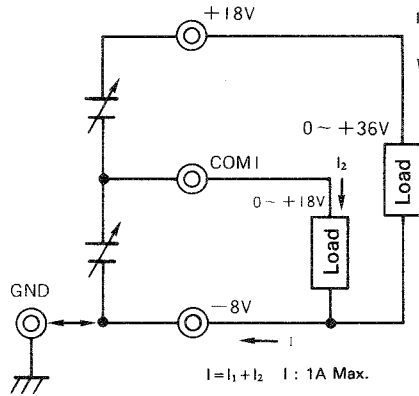
NOTE: Do not attempt to connect two positive outputs (+18 V and +8 V) or two negative outputs (-6 V and -18 V).

2) PWR18-1T Serial Output Application

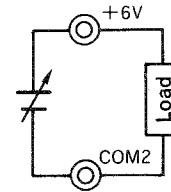
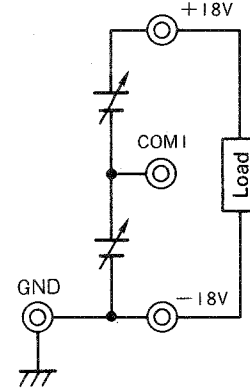
Usage for complimentary output



Usage for homopolar double output



Usage for serial output



NOTE: It is possible to connect the GND line either to the COM2 or +6 V terminal

8. MAINTENANCE

8-1 Removing the Case

To remove the case of the unit, remove the screws on the top and sides of the unit and lift the case upwards.

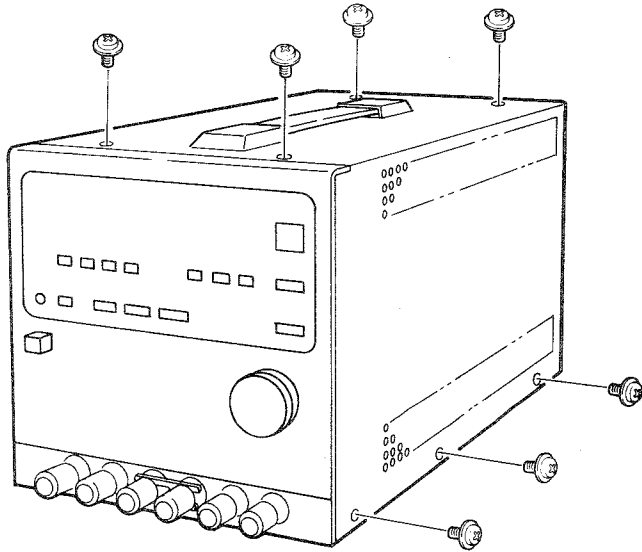


Fig. 17

8-2 Changing the Power Voltage

To change the rated input voltage, change the rated values of the power transformer and fuse inside the unit as described in the following section:

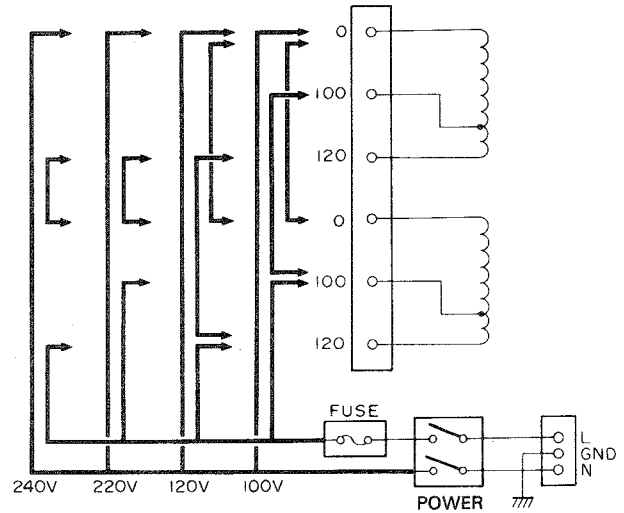
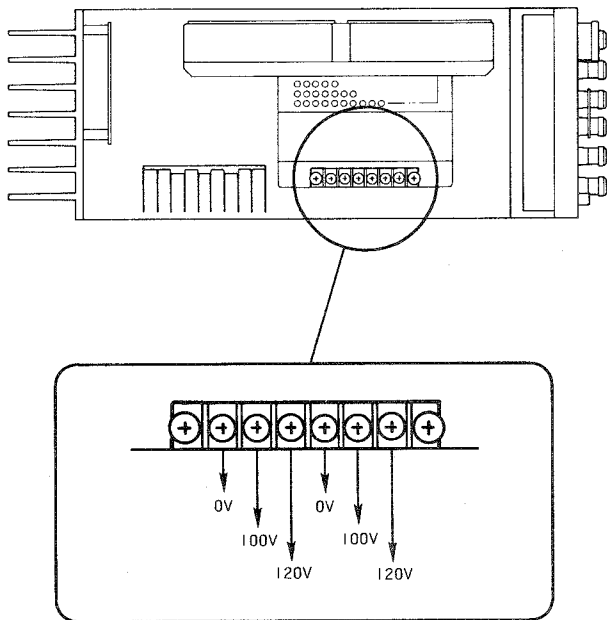


Fig. 18



Voltage selector terminal

Fig. 19

8-3 Replacing the Fuse

If the fuse burns out, investigate the cause before replacing it. Replace it with a rated fuse that corresponds to the new power voltage (see the table).

Be sure to disconnect the power cord from the AC outlet before replacing the power voltage or the fuse.

Table (Rated fuses)

Model	100V	120V	220V	240V
PWR18-1T	2.5A(TL)	2.5A(TL)	1.5A	1.5A
PWR18-1.8Q	3A(TL)	3A(TL)	1.5A(TL)	1.5A(TL)

(TL): Time lag fuse

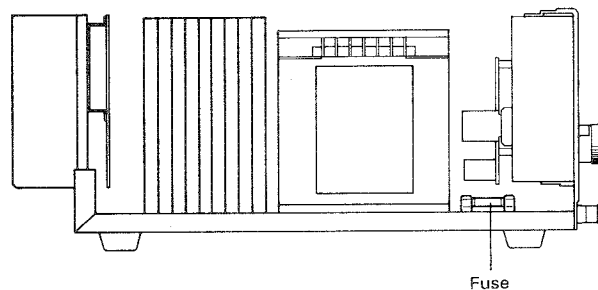


Fig. 20

9. TROUBLE SHOOTING

Trouble	Check point	Cause
The unit cannot be turned on.	None of the LEDs light up within 5 minutes after the power turned ON.	<ul style="list-style-type: none">– The power cord is not connected or is broken.– The power switch is defective.– The fuse is burnt.
Excessive output	Neither the output voltage nor the output current decreases.	<ul style="list-style-type: none">– The power transistor is broken or the control circuit is malfunctioning.
Unstable output	<ol style="list-style-type: none">1) Is there any change in the power voltage?2) Can any oscillation be observed?3) Is any strong magnetic or electric field present near the unit?	<ol style="list-style-type: none">1) The power voltage exceeds the limits of a rated input voltage.2) Oscillation can be caused by special types of loads.3) The unit should be separated from the oscillating source.

10. EXTERNAL DIMENSIONS FIGURE

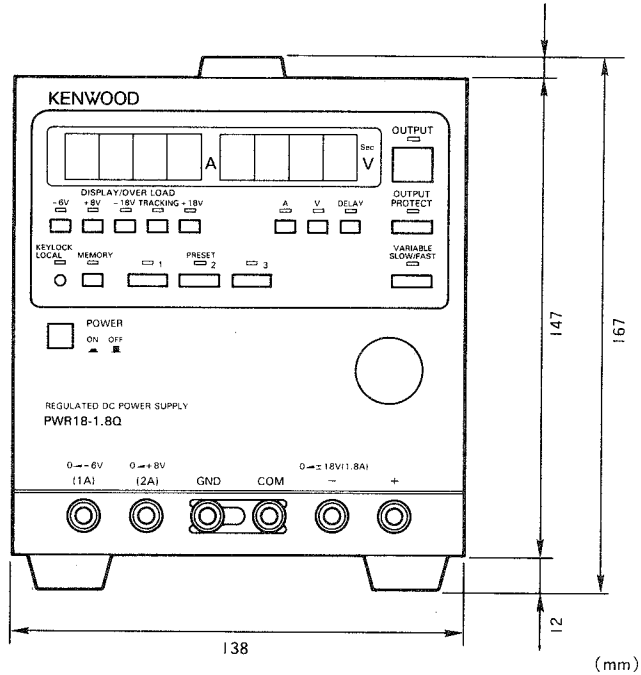


Fig. 21

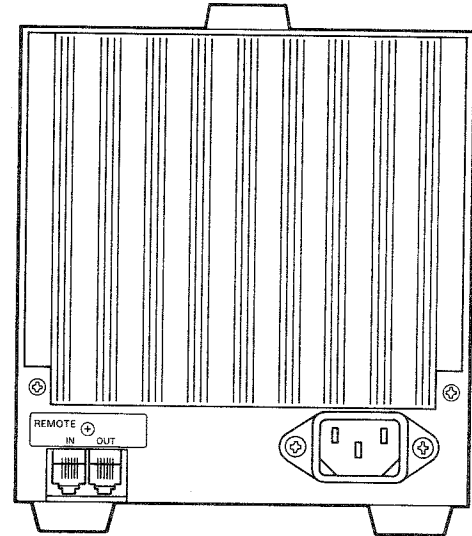


Fig. 22

* Dimensions of the PWR18-1T are identical.

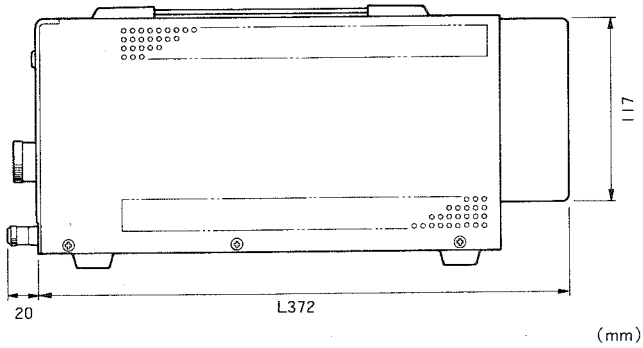


Fig. 23

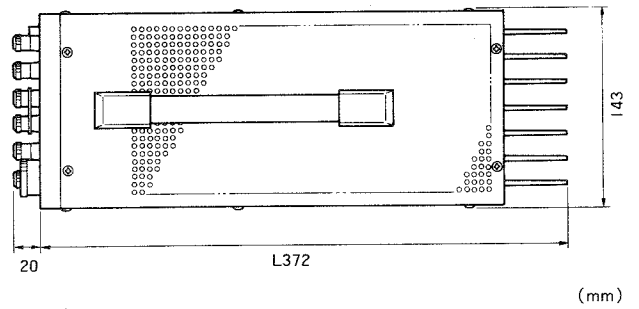


Fig. 24

* Dimensions of the PWR18-1T are identical.

A product of
KENWOOD CORPORATION
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