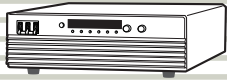


Setup Guide

Regulated DC Power Supply PAT-T series

4kW type	8kW type	
PAT20-200T	PAT20-400T	PAT250-32T
PAT40-100T	PAT30-266T	PAT350-22.8T
PAT60-67T	PAT40-200T	PAT500-16T
PAT160-25T	PAT60-133T	PAT650-12.3T
	PAT80-100T	PAT850-9.4T
	PAT160-50T	



8kW type (Custom model)
PAT1000-8T (SPEC21163)
PAT1500-5.3T (SPEC21164)

Thank you for purchasing the PAT-T Series Regulated DC Power Supply.

The PAT-T Series is a low-noise, highly efficient Constant Voltage (CV)/ Constant Current (CC) automatic crossover power supply that employs a software switching system.

PAT-T Series models

The PAT-T Series consists of the 4 kW type and 8 kW type. On the 4 kW type, you can select the input mode: single-phase input or three-phase input. The 8 kW type is three-phase input. The 8 kW type consists of the 200 V input model and 400 V input model (200 V input only for the PAT1000-8T/PAT1500-5.3T).

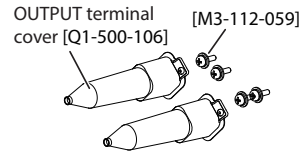
Output power	Model	Input mode	Rated voltage	Input rating
4 kW type	PAT20-200T	Single-phase/ three-phase selectable	20 V	200 V
	PAT40-100T		40 V	
	PAT60-67T		60 V	
	PAT160-25T		160 V	
8 kW type	PAT20-400T	Three-phase	20 V	200 V 400 V
	PAT30-266T	Three-phase	30 V	200 V 400 V
	PAT40-200T	Three-phase	40 V	200 V 400 V
	PAT60-133T	Three-phase	60 V	200 V 400 V
	PAT80-100T	Three-phase	80 V	200 V 400 V
	PAT160-50T	Three-phase	160 V	200 V 400 V
	PAT250-32T	Three-phase	250 V	200 V 400 V
	PAT350-22.8T	Three-phase	350 V	200 V 400 V
	PAT500-16T	Three-phase	500 V	200 V 400 V
	PAT650-12.3T	Three-phase	650 V	200 V 400 V
	PAT850-9.4T	Three-phase	850 V	200 V 400 V
	PAT1000-8T	Three-phase	1000 V	200 V
	PAT1500-5.3T	Three-phase	1500 V	200 V

Checking the Package Contents

When you receive the product, check that all accessories are included and that the accessories have not been damaged during transportation. If any of the accessories are damaged or missing, contact your Kikusui agent or distributor. We recommend that you save all packing materials, in case the product needs to be transported at a later date.

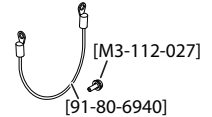
Accessory

- 4 kW type/ 8 kW type



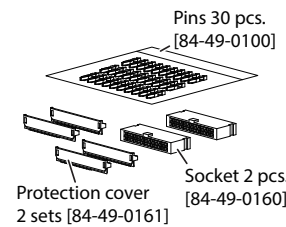
Model of rated output
20 V to 850 V (2 sets)

- OUTPUT terminal cover set



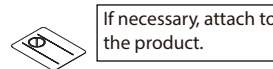
- Chassis connection wire set (1 set)

* Chassis connection wire only for the PAT1000-8T/PAT1500-5.3T



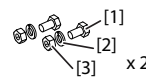
Model of rated output
20 V to 850 V

- J1/J2 connector kit

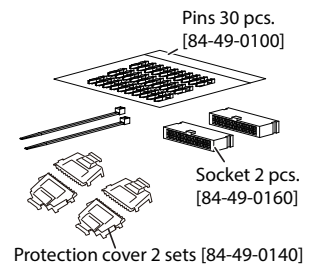


- Heavy object warning label (1 pc.) [A8-900-153]

- Setup Guide (1 pc.)



- Output terminal bolt set (2 sets)
* Not included with the PAT1000-8T/PAT1500-5.3T



Model of rated output
1000 V, 1500 V

- CD-ROM (1 pc.)

- Safety information (1 pc.)

- Quick Reference (Japanese: 1 pc., English: 1 pc.)

	4 kW type		8 kW type	
	20 V to 160 V	20 V, 30 V	40 V to 160 V	250 V to 850 V
Rated voltage				
Size	M10 set	M12 set	M10 set	M8 set
[1]	M1-100-119	M1-100-127	M1-100-119	M1-100-113
[2]	M5-101-008	M5-101-009	M5-101-008	M5-101-007
[3]	M4-100-008	M4-100-009	M4-100-008	M4-100-007

KIKUSUI ELECTRONICS CORP.

1-1-3 Higashiyamata, Tsuzuki-ku, Yokohama,
224-0023, Japan

Tel: +81-45-482-6353

Fax: +81-45-482-6261

www.kikusui.co.jp/en



Features

The PAT-T Series is equipped with the following features.

- **Reduction of harmonic current and power transmission loss**

The power-factor improvement circuit reduces the effects of harmonic currents on the input power line. It also suppresses the peak current and reduces the power transmission loss.

- **Master-Slave parallel operation**

Up to five power supplies can be connected in parallel to expand.

- **Output limit function**

You can set the upper limit of current and voltage that is applied when setting the output. This function is used to prevent setting inappropriate value by mistake.

- **Remote interface**

Equipped with RS232C as standard. You can select the GPIB, USB or LAN interface as a factory option. The remote interface complies with IEEE 488.2 std 1992 and SCPI Specification 1999.0. Because the LAN interface complies with the LXI standard, the construction of a highly cost-effective system is possible.

- **High efficiency and low noise**

The PAT is a highly efficient, low-noise power supply that employs a software switching system. High power conversion efficiency has reduced the rise in the internal temperature and has contributed to the product's compact and light design.

- **Downsized input distribution device**

The input distribution device (breaker) can be downsized, because the built-in power-factor improvement circuit reduces the required input current.

- **Preset memory function of settings**

Up to three output setting presets (combination of current and voltage) can be saved. You can simply select a preset to set the output without having to set the voltage and current every time you use the PAT.

- **Output on/off delay function**

You can set a delay until the output is actually turned on or off after turning the OUTPUT switch on or off. For example, this feature is useful if you want to turn the output on/off by setting a time offset according to the load characteristics.

- **Selectable input power for the three-phase input mode or single-phase input mode (Only 4 kW type)**

The input power mode can be switched from "three-phase input to single-phase input" or "single-phase input to three-phase input" by the CONFIG setting. In the single-phase input mode, output current is limited to 75 % of the rating of three-phase input mode.

Precautions Concerning Installation

- **Avoid locations where the product is exposed to high temperature or direct sunlight.**

Do not install the product near a heater or in areas subject to drastic temperature changes.

Operating temperature range: 0 °C to +50 °C (32 °F to 122 °F)

Storage temperature range: -25 °C to +70 °C (-13 °F to 158 °F)

- **Avoid humid environments.**

Do not install the product in high-humidity locations—near a boiler, humidifier, or water supply.

Operating humidity range: 20 %rh to 85 %rh (no condensation)

Storage humidity range: 90 %rh or less (no condensation)

Condensation may occur even within the operating relative humidity range. If this happens, do not use the product until the condensation dries up completely.

About the PAT-T Documentation

This manual is intended for users of the product or persons teaching other users on how to operate the product.

The manual assumes that the reader has knowledge about Power Supply.

The Operation Manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact Kikusui distributor/agent.

If you find any incorrectly arranged or missing pages in the manual, they will be replaced. If the manual gets lost or soiled, a new copy can be provided for a fee. In either case, please contact Kikusui distributor/agent, and provide the "Kikusui Part No." given on the cover.

After reading, always keep the manual nearby so that you may

refer to it as needed.

Documentation Structure

■ User's manual (PDF)

The User's manual is intended for first-time users of this product. It provides an overview of the product and notes on usage. It also explains how to configure the product, operate the product, perform maintenance on the product, and so on.

■ Setup Guide (This guide)

This guide is intended for first-time users of the product. It gives an overview of the product, connecting procedures, etc. Please read through and understand this guide before operating the product.

■ Quick Reference

The quick reference briefly explains the panel description and the basic operation of the product.

■ Safety information

This document contains general safety precautions for this product. Keep them in mind and make sure to observe them.

■ Communication Interface Manual (HTML, PDF)

This manual contains details about remote control.

Interface manual is written for readers with sufficient basic knowledge of how to control instruments using a personal computer.

Notations used in the PAT-T manual

In this manual, the PAT-T Series regulated DC power supply is often simply referred to as "the PAT."

The word "PC" used in this manual is a generic term for personal computers and workstations.

The screen captures used in this manual may differ from the actual screens that appear on the PAT-T. The screen captures are merely examples.

The following markings are used in the explanations in the manual.

⚠ WARNING
Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.

⚠ CAUTION
Indicates a potentially hazardous situation which, if ignored, may result in damage to the product or other property.

- Note -
Indicates information that you should know.

- DESCRIPTION -
Explanation of terminology or operation principle.

(SHIFT+key name)

Indicates an operation in which a switch marked in blue is pressed while holding down the SHIFT key.

Contents of the Included CD-ROM

Put the included CD-ROM into the CD-ROM drive. In a few moments, a start window will appear. If the start window does not appear, open the CD-ROM folder in Windows Explorer, and then double-click index.html to display the start window.



Accompanying CD-ROM contains following the items.

- Driver
IVI-COM、KI-VISA
- Operation Manual
User's Manual (PDF)
Communication Interface Manual (HTML)

Click the item you want to view to move to the corresponding page.

Connecting the Power Cable

This product conforms to IEC Overvoltage Category II (energy-consuming equipment that is supplied from a fixed installation).

⚠ WARNING
Possible electric shock.

- Turn off the switchboard breaker before making the connection.
- This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). Be sure to ground the product to prevent electric shock.
- Connect the ground terminal to earth ground.
- Be sure to have a qualified engineer connect the power cable to the switchboard.

⚠ CAUTION

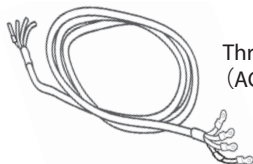
Inside the power supply, an appropriate protective circuit is connected to the input terminal. Be sure to connect the wires correctly by following the instruction for the connection.

— Note —

The POWER switch of the product can be used to disconnect the product from the AC line in an emergency. Provide adequate space around the POWER switch so that the POWER switch can be turned off at any time.

A power cable is not included with this product. Use a power cord that conforms to this product's rated AC input voltage and current.

The following specialized power cables (for the three-phase input) are available as options. The crimping terminals connecting to the PAT are already assembled. When you are wiring the switchboard, attach crimping terminals that match the screws of the switchboard.



Three-phase power cable (AC8-4P4M-M6C)

If you will not use one of the optional input power cords, prepare an appropriate power cable indicated below.

Type	Input mode	Cable	Nominal cross-sectional area
4 kW type	Single-phase input	Three-core PVC insulated cable for 600 Vac	5.5 mm ² or more
	Three-phase input	Four-core PVC insulated cable for 600 Vac	3.5 mm ² or more
8 kW type	Three-phase input		8 mm ² or more (5.5 mm ² or more for 400 V model)

■ Tightening torque of input terminal connection screws

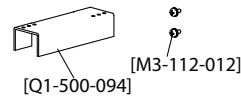
	Tightening torque [N · m]
M6	3.0

When the PAT is shipped from the factory, terminal block cover is attached to the AC INPUT terminal block. Keep terminal block cover that you remove in a safe place. If you are not using a AC INPUT terminal block, attach the terminal block cover for safety reasons. If they are damaged or lost, contact your Kikusui agent or distributor.

Connecting the 4 kW type

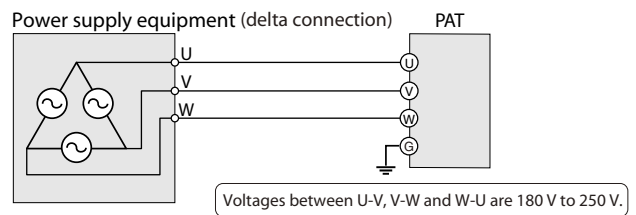
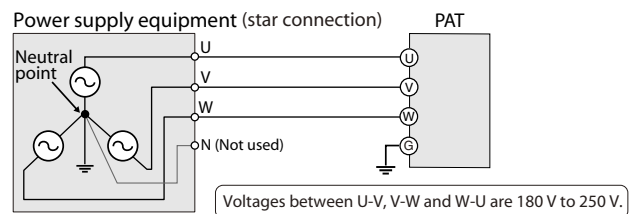
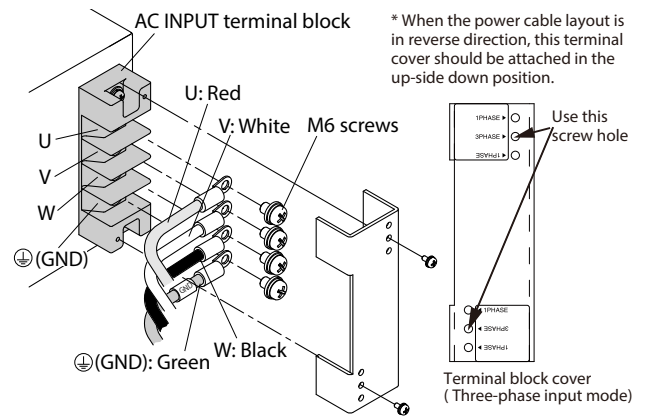
⚠ WARNING
Possible electric shock. A maximum current of 17 A in the three-phase input mode and 22 A in the single-phase input mode flows in the PAT at the rated load.

When switching the mode from the three-phase input mode to the single-phase input mode, Be sure to use the appropriate type of power cable as specified following instruction and refer to the connection procedure for the single-phase input mode.



□ Input terminal block cover set (1 set)

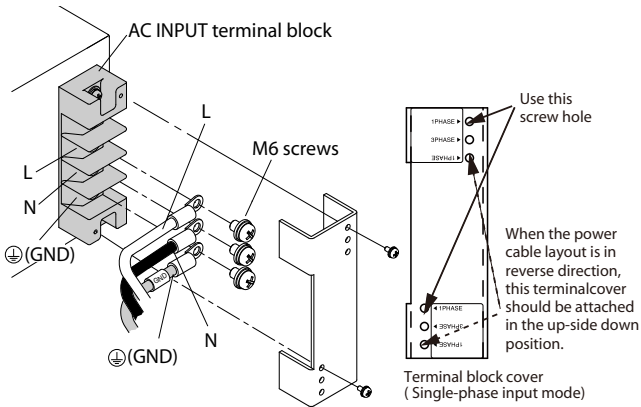
■ Connection procedure the Three-phase Input Mode



■ Connection procedure the Single-phase Input Mode

⚠ WARNING

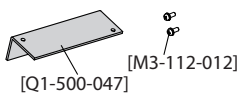
Possible electric shock. When connecting the input power in single-phase input mode, the voltage around 100 V to 150 V are applied to the U terminal (the terminal used for the three-phase input mode) on the input terminal board. When in single-phase input mode, be sure to connect the power cable to the L terminal and the N terminal, and connect the ground terminal (GND terminal) to earth ground.



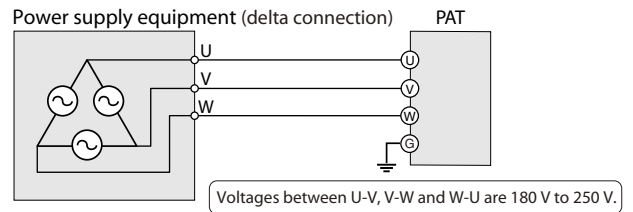
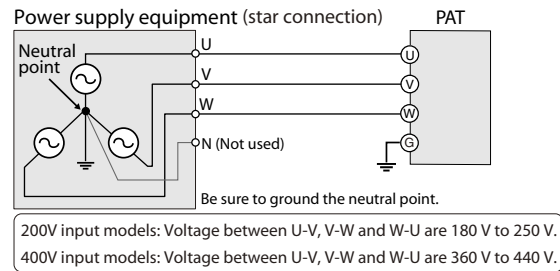
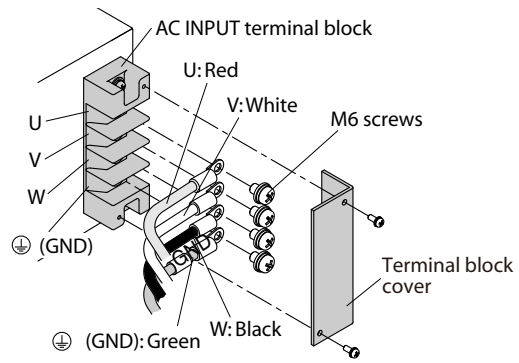
■ Connection procedure

- 1** Check that the AC power supply meets the nominal input rating of the product.
The voltage that can be applied is any of the nominal power supply voltages in the range of 200 Vac to 240 Vac. The frequency is 50 Hz or 60 Hz.
- 2** Check that the POWER switch is turned off.
- 3** Attach crimping terminals to the cable that are appropriate for the PAT, and then connect the cable to the AC INPUT terminal block.
- 4** Attach crimping terminals to the switchboard end of the power cable.
Attach crimping terminals that comply with the terminal screws on the switchboard.
- 5** Turn off the switchboard breaker.
- 6** Connect the power cable by matching the U, V, W, and ⊕ (GND), or matching the L, N, and ⊕ (GND) terminal of the switchboard.

Connecting the 8 kW type



- Input terminal block cover set (1 set)



⚠ CAUTION

The PAT may be damaged. Do not connect a 400 V input model to a power line if the voltage between any of the line's phase terminals and the ground exceeds 254 Vac.

- 1** Check that the AC power line meets the nominal input rating of the product.
A model with a nominal input rating of 200 Vac to 240 Vac can receive voltages within the range of 180 Vac to 250 Vac. 400 V input models (whose nominal input rating is 400 Vac) can receive voltages within the range of 360 Vac to 440 Vac. The frequency is 50 Hz or 60 Hz.
- 2** Check that the POWER switch is turned off.
- 3** Attach crimping terminals to the cable that are appropriate for the PAT, and then connect the cable to the AC INPUT terminal block.
- 4** Attach crimping terminals to the switchboard end of the power cable.
Attach crimping terminals that comply with the terminal screws on the switchboard.
- 5** Turn off the switchboard breaker.
- 6** Connect the power cable by matching the U, V, W, and ⊕ (GND) of the switchboard.

Turning the Power On

CAUTION

The CONFIG parameters can be configured so that the output is automatically turned on when the POWER switch is turned on. When this function is enabled, the PAT powers up with the output turned on even if the output was off when the PAT was turned off the last time. However, there is a possibility that a load may break, if you connect a different load and turn the POWER and output on simultaneously without changing the OVP and OCP settings to appropriate values.

Switching the phase input mode (Only 4 kW type)

On the 4 kW type, you can use CONFIG parameter CF31 to switch the input mode (single-phase input or three-phase input).

Three-phase input mode

The phase input mode is set for the three-phase input mode at the time of factory shipment. Therefore, when the power is turned on, the three-phase input mode is activated.

Single-phase input mode

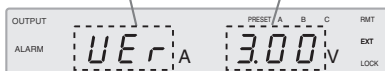
Set CONFIG parameter CF31 to 1PHA to select single-phase input mode. Press the POWER switch to turn on while pressing the STORE key. Once the single-phase input mode is set, the product will be started in the single-phase input mode next time just by pressing the POWER switch. If the input power connected to the single-phase input wiring, and press the POWER switch without pressing the STORE key, the PAT will detect the open-phase by the function of "Input open-phase protection (PHASE)", and the PAT will not be turned on.

Turning the POWER switch on

- 1 Check that the power cable is correctly connected.
- 2 Raise the lever and turn the POWER switch on.
- 3 Check the firmware version on the front panel display.

The voltmeter and ammeter show the PAT firmware version for approximately 1 second. The measuring value will be shown after the firmware version is displayed.

Indicates the version Firmware version



If the POWER switch is turned on for the first time after purchasing the PAT, the PAT starts up in a factory default condition.

An inrush current flows up to 100 Amax. (40 Amax. for 400 V input model) when the POWER switch is turned on. In

particular, check that sufficient current capacity is available in the AC power line and the switchboard if you are using multiple PATs and turning on the POWER switches simultaneously.

If front panel display shows indicated the following after power-on, follow the corresponding remedy. If the remedy does not correct the problem, contact your Kikusui agent or distributor.

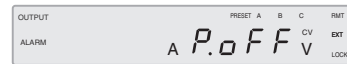
Panel display during and after power-on

Panel Display	Cause and Remedy
SYS1 ERR SYS1 ERR	The PAT may have malfunctioned. Contact your Kikusui agent.
SYS2 ERR SYS2 ERR	The calibration has not been completed normally. Recalibrate. If "SYS2 ERR" appears even after recalibration, the PAT may have malfunctioned. Contact your Kikusui agent.
CLR ABC CLR ABC	Preset memories A, B, and C have been reset to factory default settings because the values were abnormal. To continue the operation, press any panel key.
CLR SET CLR SET	The voltage and current calibration values have been reset to factory default settings, because the values were abnormal. To continue the operation, press any panel key.
CLR CONF CLR CONF	The CONFIG settings have been reset to factory default values, because the values were abnormal. To continue the operation, press any panel key.

Turning the POWER switch off

Lower the POWER switch lever to turn it off.

When the POWER switch is turned off, the front panel display shows the characters indicated in the following figure for about 10 to 15 seconds.



The PAT stores the panel settings (excluding output on/off condition) immediately before the POWER switch is turned off. For these items, the PAT starts up using the settings that existed when the POWER switch was turned off the last time.

If the POWER switch is turned off immediately after changing the settings, the last settings may not be stored.

CAUTION

When turning the POWER switch off and then back on, allow at least 10 seconds (40 seconds for 400 V input model) after the fan stops. Repeated ON/OFF of the POWER switch at short intervals can cause damage to the inrush current limiter or shorten the service life of the POWER switch and the internal input fuse.

Connecting the Load

Note that the output will become unstable if the following types of loads are connected.

- Load with peaks and pulse-shaped current
- Load that generates reverse current to the power supply
- Load with accumulated energy

Load Cable

⚠ WARNING

To prevent the possibility of fire.

- Use a load cable with sufficient current capacity with respect to the rated output current of the PAT.
- The output terminal and its area nearby gets very high temperature, use the cable with sufficient an allowable temperature higher than 85 °C of the covering materials.

Possible electric shock.

- Use a load cable with a higher voltage rating than the isolation voltage of the PAT. For the isolation voltage of each model, see "Specifications."

Nominal cross-sectional area of cables and allowable currents

Nominal cross-sectional area [mm ²]	AWG	(Reference cross-sectional area) [mm ²]	Allowable current * [A] (Ta = 30 °C, 86 °F)	Kikusui-recommended current (A)
2	14	(2.08)	27	10
3.5	12	(3.31)	37	-
5.5	10	(5.26)	49	20
8	8	(8.37)	61	30
14	6	(13.3)	88	50
22	4	(21.15)	115	80
30	2	(33.62)	139	-
38	1	(42.41)	162	100
50	1/0	(53.49)	190	-
60	2/0	(67.43)	217	-
80	3/0	(85.01)	257	200
100	4/0	(107.2)	298	-
125	-	-	344	-
150	-	-	395	300
200	-	-	469	400

* Excerpts from Japanese laws related to electrical equipment.

Connecting to the Output terminal

⚠ WARNING

Possible electric shock.

- Be sure to turn the **POWER** switch off before touching the output terminal.
- Be sure to attach the **OUTPUT** terminal cover after wiring the load.

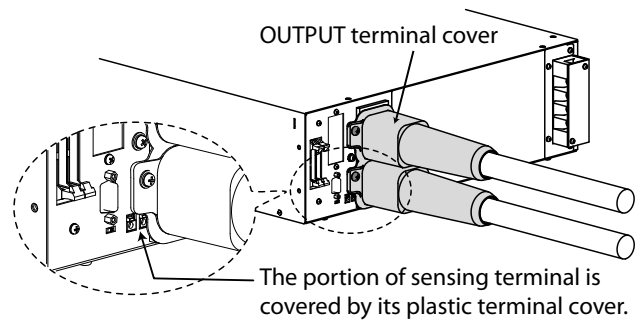
Tightening torque of output terminal connection screws

	Tightening torque [N · m]
M4	1.2
M8	11.22
M10	22.46
M12	33.06

Model of rated output 20 V to 850 V

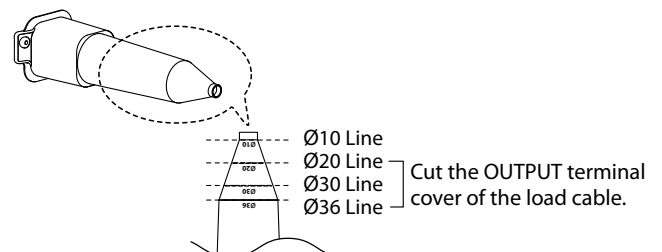
Connection preparation

After the installation of the OUTPUT terminal cover for the output terminal, the portion of the terminal cover is on top of the sensing terminal. In case the remote sensing is used, install the OUTPUT terminal cover after wiring of the sensing cable.



How to use the OUTPUT terminal cover for the output terminal

Cut the sleeve of the OUTPUT terminal cover for the appropriate size of the load cable which goes through its OUTPUT terminal cover.



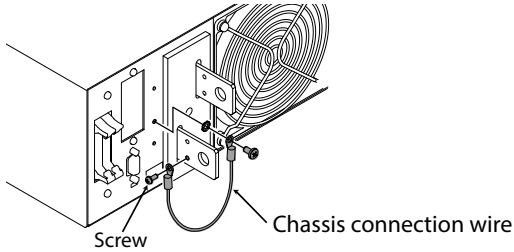
Connecting the Load (Cont'd)

Connection procedure

1 Turn the **POWER** switch off.

2 Using the **chassis connection wire set that comes with the package, connect the chassis terminal to either the negative or positive DC output terminal.**

The output terminal has a hole used to connect the chassis connection cable that comes with the package.



	4 kW type			
Rated voltage	20 V to 160 V			
Size	M10 set			

	8 kW type			
Rated voltage	20 V, 30 V	40 V to 160 V	250 V to 850 V	1000 V, 1500 V
Size	M12 set	M10 set	M8 set	M4

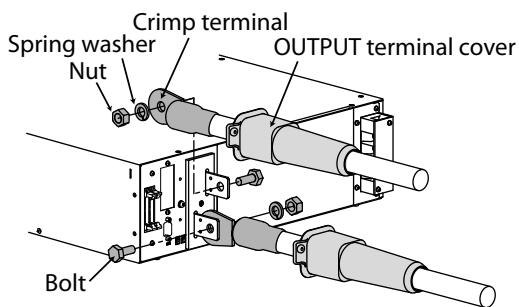
3 **Attach crimping terminals to the load cable.**

The output terminal has a hole for connecting the load cable. Attach the crimping terminal that matches the bolt used.

4 **Insert the load cable through the OUTPUT terminal cover.**

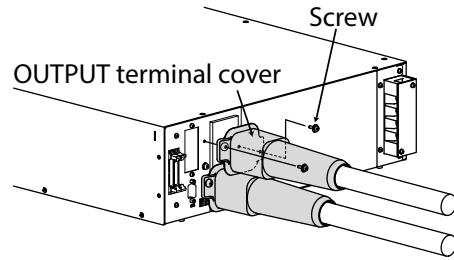
5 **Connect the load cable on the rear panel.**

Insert the bolt for the positive (+) terminal from right side, and the negative (-) terminal from left side as you face, then fix it using the nut and spring washers. Connect the load cable straight forward (vertical angle against the surface of the output terminal).



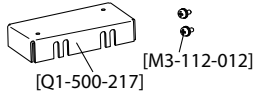
6 **Install the OUTPUT terminal cover on the rear panel.**

Uses the attached screws to install the OUTPUT terminal cover firmly and make sure they are not loosen.



■ Model of rated output 1 000 V and 1 500 V

When the PAT is shipped from the factory, terminal block cover is attached to the OUTPUT terminal block. Keep terminal block cover that you remove in a safe place. If you are not using a OUTPUT terminal block, attach the terminal block cover for safety reasons. If they are damaged or lost, contact your Kikusui agent or distributor.



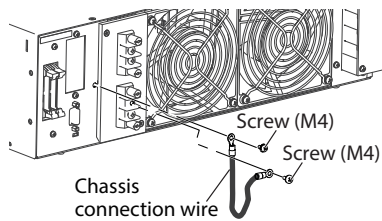
□ OUTPUT terminal cover set (1set)

Connection procedure

1 Turn the **POWER** switch off.

2 Using the **chassis connection wire** that comes with the package, connect the chassis terminal to **either the negative or positive DC output terminal**.

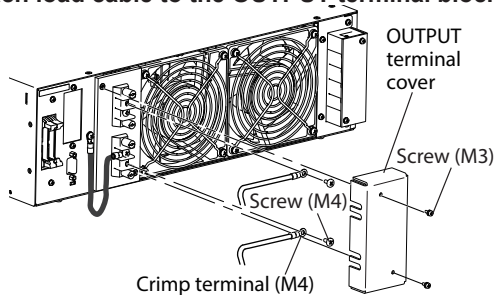
Connect to the output terminal using the screws fixed on the rear panel.



3 Attach crimping terminals to the load cable.

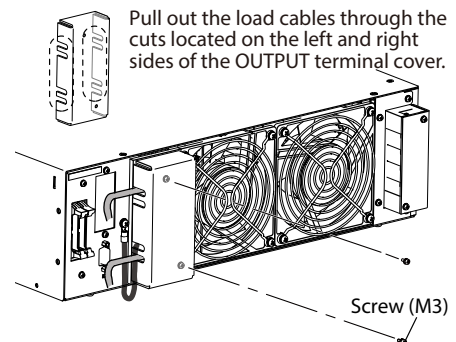
Attach crimping terminals that are appropriate for the output terminals (M4).

4 Attach load cable to the **OUTPUT terminal block**.



5 Attach **OUTPUT terminal cover** to the **OUTPUT terminal block**.

Uses the attached screws to install the OUTPUT terminal cover firmly and make sure they are not loosen.



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有毒有害物质或元素名称及含有标示

Name of hazardous materials and symbol of element in the equipment and quantity

部件名称 Name of part	有毒有害物质或元素 Hazardous material and symbol of element					
	铅 Pb	汞 Hg	镉 Cd	六价铬 Cr(VI)	多溴联苯 PBB	多溴二苯醚 PBDE
印刷电路板组装品 PCB assemblies	×	○	×	○	○	○
内部接线 Internal wirings	×	○	○	○	○	○
外壳 Enclosure	×	○	○	○	○	○
底盘组装品 (含变压器) Chassis assy (xfrs included)	×	○	×	○	○	○
辅助设备 Accessories	×	○	○	○	○	○

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