OPERATION MANUAL

PCR-LT SERIES

AC POWER SUPPLY

PCR 6000LT
PCR12000LT

KIKUSUI

The product specifications and the contents of this operation manual are subject to change without notice.

KIKUSUI PART NO. Z1-000-432 IB000074

This manual applies to the products with any of the 2.00 to 2.09 version ROMs. To inquire about the product, you should provide us with the:

- Model number
- ROM version
- Serial number and the revision number
  (These are indicated at the lower rear part of the equipment.)

If you are using a PCR-LT Series AC power supply for the first time or after reinstalling it, always read:

"FOR SAFETY USE"
Chapter 2 "INSTALLATION"
Chapter 3 "WIRING AND CONNECTING THE INPUT POWER BETWEEN THE U-, V-, AND W-PHASE POWER SUPPLIES"
Chapter 4 "OPERATION CHECK"

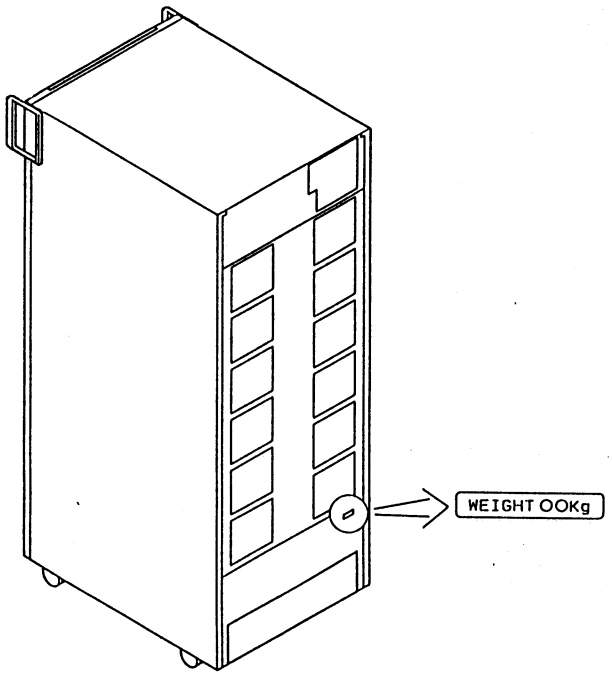
These chapters describe the basics of using the AC power supply. Perform the operations described in these chapters, then check the ROM version in accordance with 4.2 "Version Check" in Chapter 4.

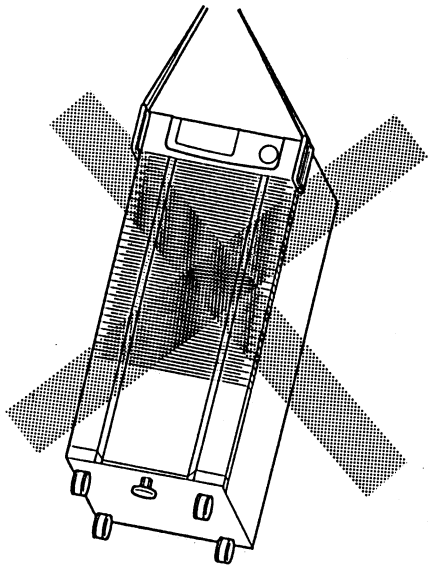
FOR SAFETY USE

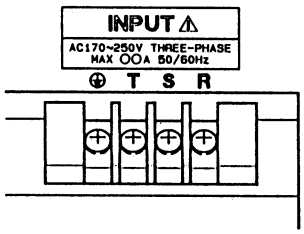
Always observe the following warnings and precautions in handling the AC power supply.

O The equipment is heavy.

- **Always use two or more personnel to move the equipment, and pay attention to steps and any inclination in the floor during movement.**
- **The weight of the equipment is indicated at the lower rear part of the equipment.**
- **For transportation using a fork-lift or crane, the equipment should be handled only by personnel qualified to use such transportation equipment.**
- **Never attempt to use grips to lift up the equipment. Grips are provided for use in moving the equipment in a flat place only. They are not strong enough to bear the weight of the equipment.**
- **When installing the equipment, take thorough consideration of the strength of the floor where the equipment is placed, and do not install it in an inclined area.**

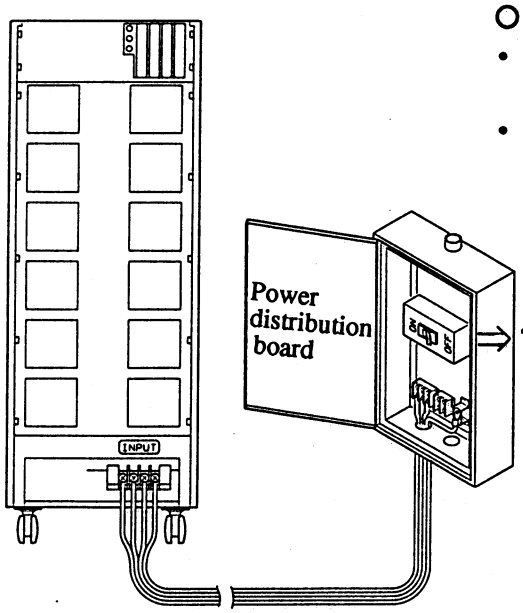






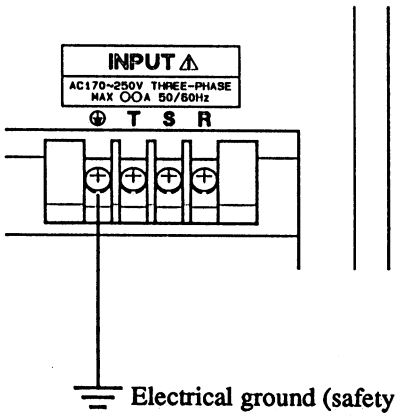
O Observe the rated input voltage range.
Rated input voltage range: 170 to 250 V
Rated input frequency range: 50/60 Hz (47 to 63 Hz)

- **Use of the equipment out of its specified range may result in malfunction or a problem.**
- **The unit should be connected to a power distribution board by a technician.**



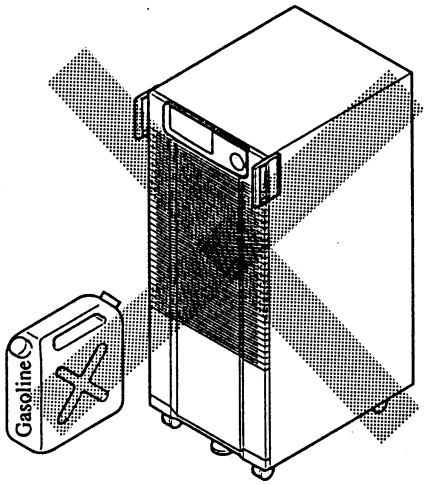
O Input power cable

- **Before handling an input power cable, always cut off power feed from the power distribution board.**
- **Always use the input power cable provided.**



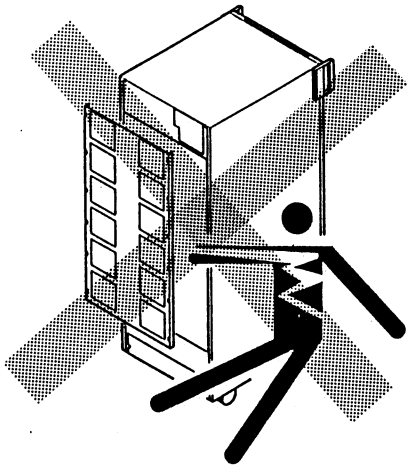
O Provide grounding.

- **To prevent electrical shock, always the equipment's grounding terminal must be connected to an electrical ground (safety ground).**
- **Neglecting to ground the grounding terminal or disconnecting the grounding terminal may result in serious injury due to electrical shock.**



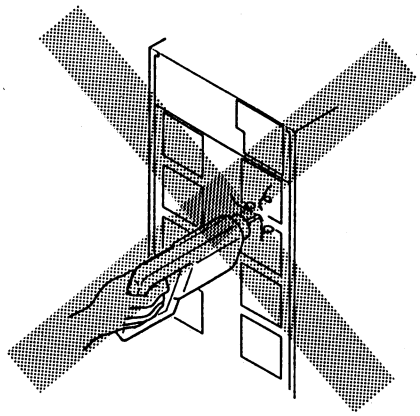
O Do not use the equipment in an explosive atmosphere.

- **Do not use the equipment in an explosive, flammable, or combustible atmosphere.**



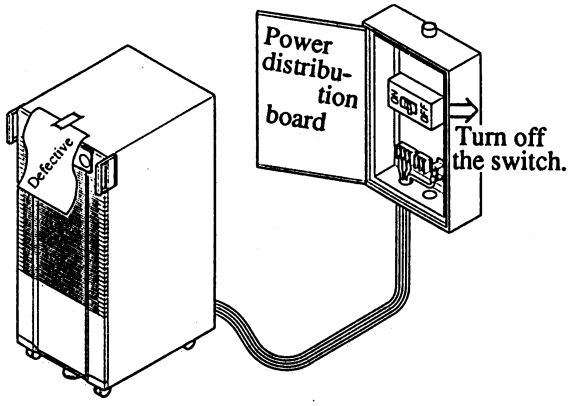
O Do not touch the equipment interior.

- **Never attempt to remove the equipment cover.**
- **High voltage is applied in the equipment interior.**
- **Touching the equipment interior may cause electrical shock.**
- **Part replacement or inspecting/adjusting the equipment interior should be conducted by qualified service personnel.**



O Do not use substitutes or modify the equipment.

- **Do not mount substitutes or modify the equipment.**
- **The equipment uses no parts that can be replaced by the customer.**

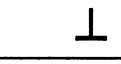


O Secure safety first in the event of a problem.

- **If the equipment is damaged or becomes defective, always cut off power feed from the power distribution board.**
- **Take measures so that the equipment will not be used by mistake until a repair has been completed.**

Warning and Precaution Symbols Indicated on the Equipment and in the Operation Manual

The following symbols are indicated where caution is especially required in handling the equipment.

Equipment	Operation manual	Description
Warning	*WARNING*	Indicates the existence of a personnel hazard. • Never fail to follow the operating procedure. Incorrect operating procedures may result in personal injury. • Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.
Caution	*Caution*	Indicates the existence of a hazard. • Always follow the operating procedure. Incorrect operating procedures may damage the equipment or other devices. • Do not proceed beyond a Caution sign until the indicated conditions are fully understood and met.
		Operation manual reference symbol • When this mark is indicated on the equipment, see the relevant section of the Operation Manual.
		Grounding terminal
		Chassis grounding
	Description	Description and supplement

CONFIGURATION OF THE OPERATION MANUAL

This operation manual is configured as follows:

Chapter 1. GENERAL **Chapter 2. INSTALLATION** **Chapter 3. WIRING AND CONNECTING THE INPUT POWER BETWEEN THE U-, V-, AND W-PHASE POWER SUPPLIES** **Chapter 4. OPERATION CHECK**	Describe the basics of the equipment use. Always read them.
Chapter 5. CONNECTING A LOAD **Chapter 6. OPERATION METHOD**	Describe the basic operating procedures.
Chapter 7. OPTIONAL EQUIPMENT **Chapter 8. PART NAMES AND OPERATIONS**	Describe the part names and their functions in detail. The options are also explained.
Chapter 9. PROTECTIVE FUNCTIONS AND THEIR OPERATIONS	Describes the protective functions and solutions in the event of a problem.
Chapter 10. MAINTENANCE	Describes daily maintenance. Always read this chapter before requesting a repair.
Chapter 11. SPECIFICATIONS AND OPERATING CHARACTERISTICS	Sets out the electrical specifications and overall dimensions.
APPENDIX	Shows the hierarchy of the control panel key operation menu.

TABLE OF CONTENTS

Chapter 1
GENERAL

Describes the AC power supply overview and features.

Contents

1.1 Outline

The PCR-LT series are highly reliable AC power supplies manufactured by the application of Kikusui Electronics advanced measuring instrument technology and long-term power supply manufacturing experience.

Use of a high power factor converter allows the equipment to be compact and lightweight, and have a low input current and low harmonic currents. Also, the combination of a high-speed linear amplifier and an arbitrary waveform synthesizer offers a variety of power simulation, various measurements using a waveform sampling measuring method, and harmonic current analysis.

The following two models are available.

Three-phase output	
Model name	Rated output capacity
PCR6000LT	6kVA
PCR12000LT	12kVA

In addition to these models, single-phase output models are also available.

1.2 Features

The PCR-LT series has the following functions in addition to high-performance constant voltage and constant frequency (CVCF) functions.

■ Various power simulations functions*

The PCR-LT series offers power-line abnormality simulations such as power failure and instantaneous voltage drop, and voltage harmonic superimposing simulatoin using a waveform output other than sine waves. This allows for a variety of power supply environmental tests.

■ Various measuring functions

In addition to output voltage rms and current rms, peak voltage and current, power, and power factor*, the harmonic components of output current can be analyzed (up to the 39th). This allows the equipment to cope with the measurement under the harmonic current regulations of public power supply.

■ Sequence function*

Allows output voltage, frequency, and waveform to change with respect to time. This facilitates an automated test.

■ Output impedance variable function*

Allows output impedance to change (normally, low output impedance). This allows measurement of equipment power consumption or harmonic current at an impedance near the actual power line.

To use a function marked * requires the purchase of an option. For the optional equipment, refer to Chapter 7.

Chapter 2
INSTALLATION

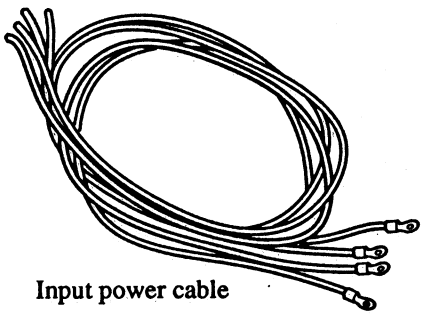
Describes the precautions to be followed in installing the AC power supply and the preparation procedures, such as power cable connection and operation checks.

Contents

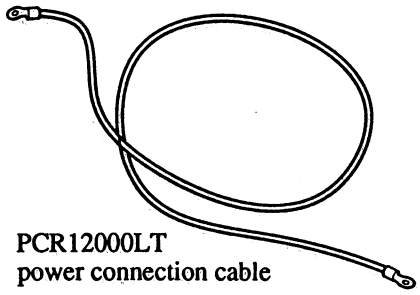
2.1 Check at Unpacking

This equipment was carefully tested and inspected both mechanically and electrically before shipment to ensure its normal operation.

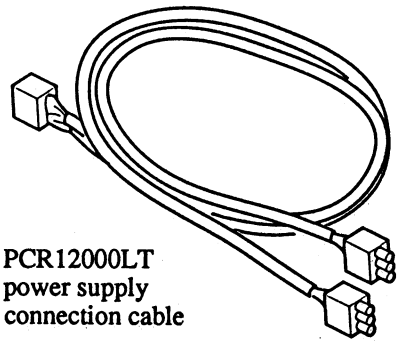
The equipment should be checked upon receipt for damage that might have occurred during transportation. Also check if all accessories have been provided (see the table on the next page). Should the equipment be damaged or any accessory missing, notify your Kikusui agent.



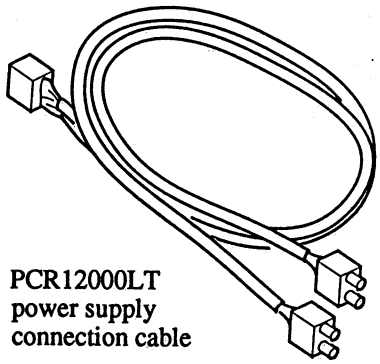
Input power cable



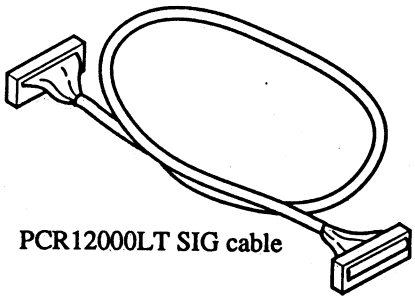
PCR12000LT
power connection cable



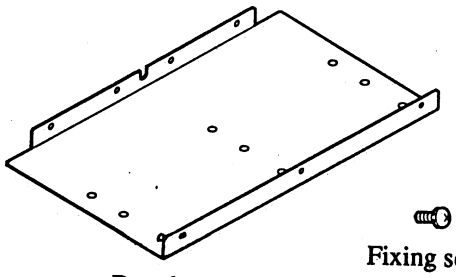
PCR12000LT
power supply
connection cable



PCR12000LT
power supply
connection cable

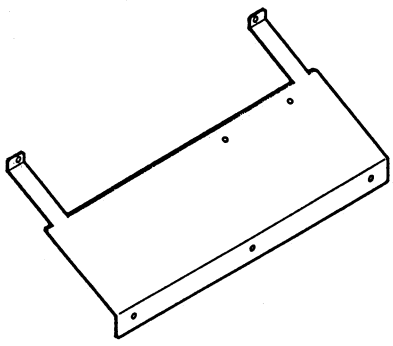


PCR12000LT SIG cable

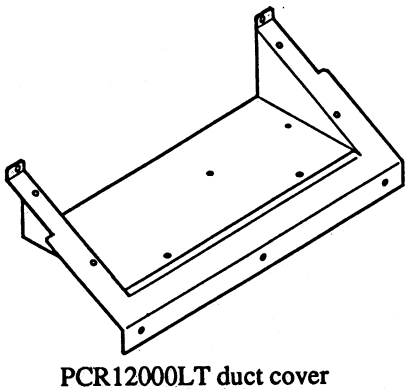


Duct base

Fixing screw

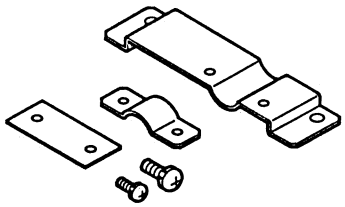


PCR12000LT duct cover
for V-, W-phase power supplies

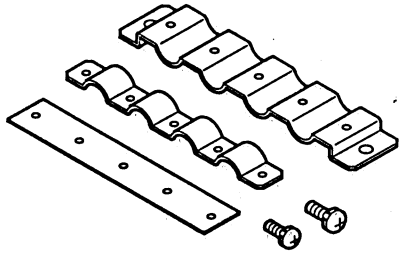


PCR12000LT duct cover
for U-phase power supply

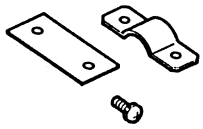
Single-touch clamper



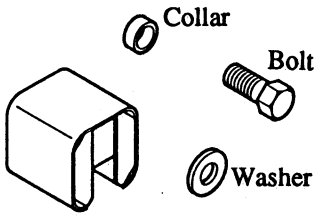
PCR6000LT cable clamper



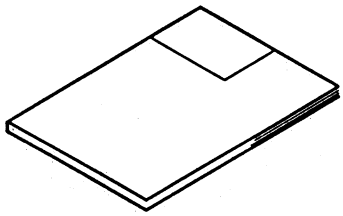
PCR12000LT cable clamper



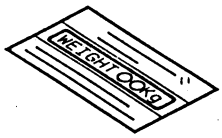
SIG cable clamper



Joint holder



Operation manual

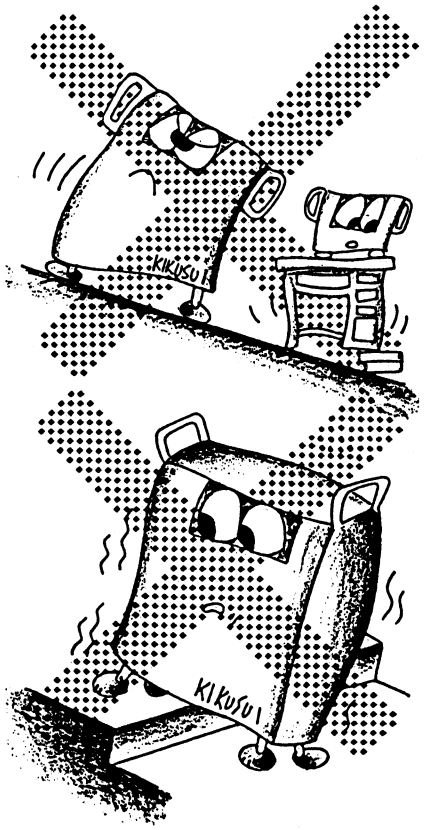


Weight seal

Accessories/Model name		PCR6000LT	PCR12000LT	Check
Input power cable	Type	Single-core cable, four	Single-core cable, four	
	Wire size (nominal conductor cross-section/length)	8 mm²/5 m	38 mm²/5 m	
Power connection cable		–	Twelve (14 mm², approx. 80 cm, Nos. ① to ⑫)	
Power supply connection cable		–	Two (Nos. ⑬, ⑭)	
SIG cable		–	Two (Nos. ⑮, ⑯)	
Duct	Duct base	–	Three	
	Duct cover		One (U-phase Power Supply) Two (V-, W-phase Power Supplies)	
	Fixing screws		M4, 27 pcs	
Single-touch clamper		–	Twelve	
Cable clampers		One set Together with fixing screws (M3: 2 pcs, M4: 2 pcs)	One set Together with fixing screws (M3: 5 pcs, M4: 2 pcs)	
SIG cable clamper		–	Four sets Together with fixing screws (M3: 2 pcs) x 4	
Connecting parts	Joint holder	–	Eight	
	Bolt		Sixteen	
	Washer		Sixteen	
	Collar		Sixteen	
Operation manual		One		
Weight seal		One	Three	

2.2 Installation and Location

Do not install this equipment in the following locations.

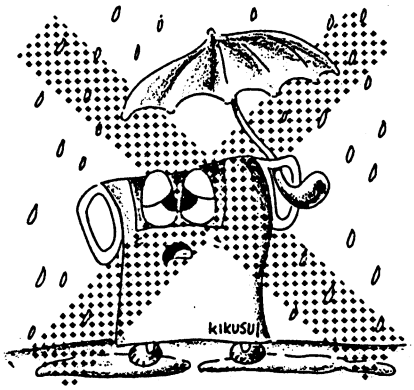


O Tilted or unsteady surfaces

- Even if the equipment is installed on a flat floor, lock the casters and use the stopper to fix the equipment to the floor surface. For further information on how to use the casters and stopper, see 2.6 "Moving Precautions."
- Do not place the equipment upside-down or with its side facing up.

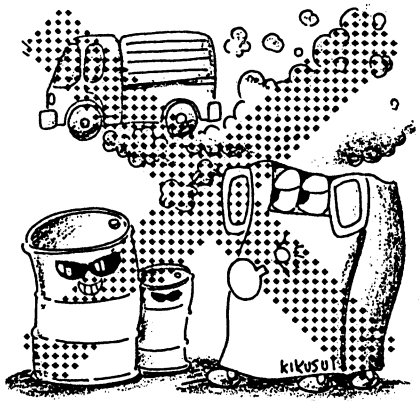
O High- or low-temperature areas or areas exposed to direct sunlight

- The operating temperature range is 0 to 40°C (32 to 104°F).
- Outdoor use is not allowed.
- Do not use the equipment outside of the above conditions. Otherwise, performance cannot be guaranteed and problems may arise.

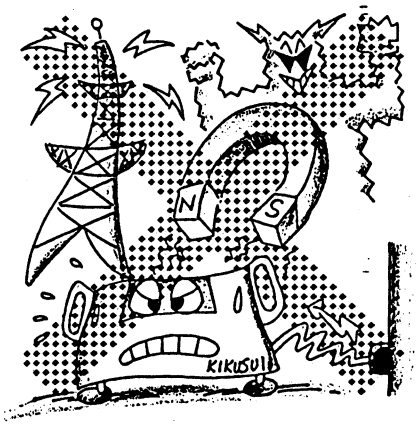


O Humid areas

- Operating humidity range is 10 to 90% R.H.
- Outdoor use is not allowed.
- Do not use the equipment outside of the above conditions. Otherwise, performance cannot be guaranteed and problems may arise.

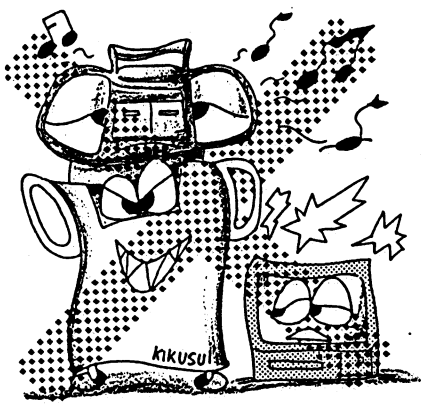


O Areas exposed to dust, corrosive gases, or inflammable materials



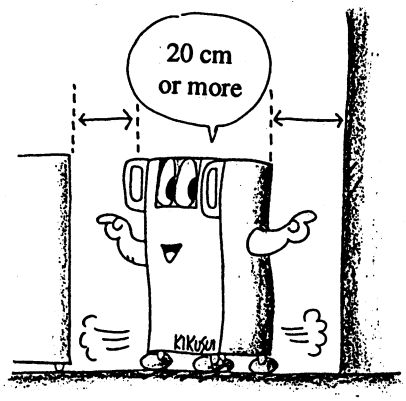
O Areas exposed to strong magnetic or electric fields or to distortion or noise from an input power line

- Installing the equipment in such an area may result in malfunctions.



O Areas where highly sensitive measuring instruments or receivers are installed

- Such instruments may be affected by the noise that this equipment generates if the equipment is installed nearby.



O Places in which the equipment's air intake or exhaust port will be blocked

Caution

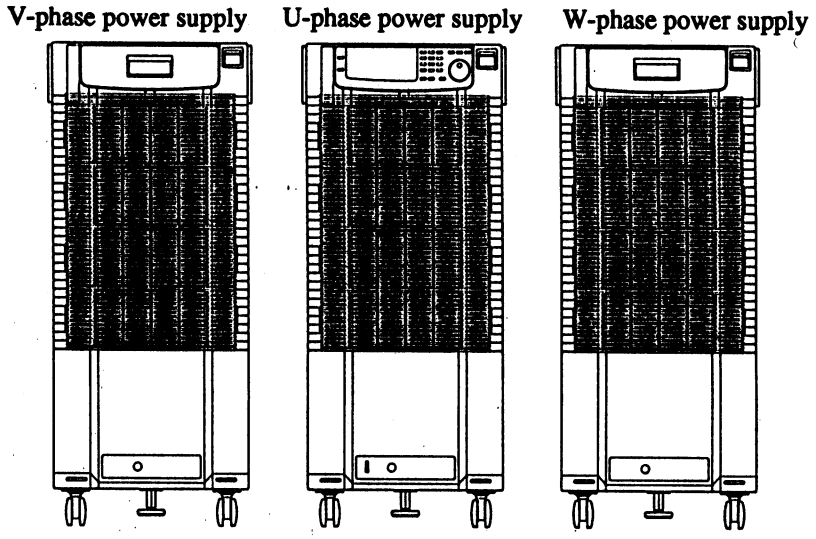
- *Always provide 20 cm or more space between the air intake and exhaust port and the wall (or interference).*
- *Hot air (about 30°C (54°F) higher than ambient temperature) comes out of the exhaust ports; do not place heat-sensitive articles near the exhaust ports.*

2.3 PCR12000LT Installation

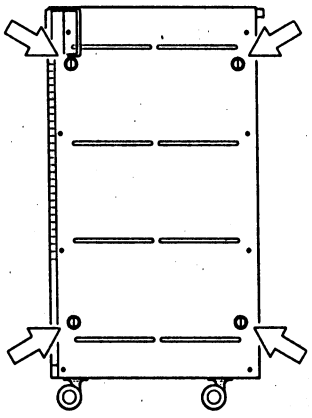
Step 1 Arrange the power supplies so that the U-phase power supply is in the middle, the V-phase power supply at the left, and the W-phase power supply at the right, when viewed from the front as shown below. The phase indication is given on the lower rear of each power supply.

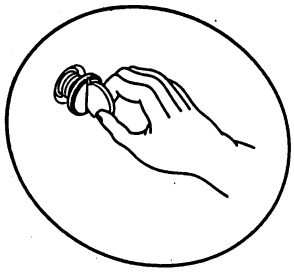
Caution

- *Place the PCR12000LT AC Power Supplies on a flat floor without any step difference or tilt.*



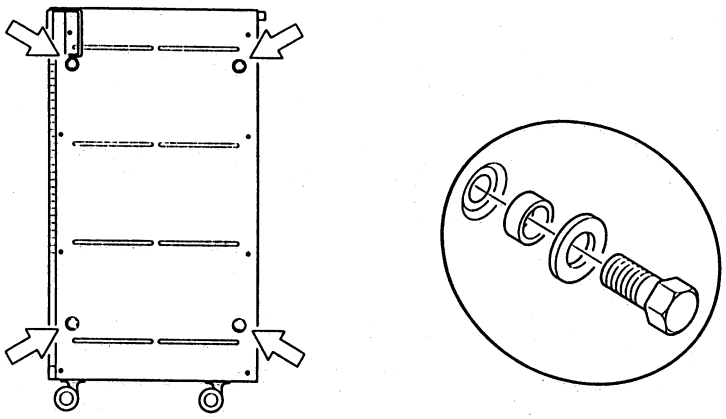
Step 2 Unscrew the plug bolts from the right and left side faces of the U-phase power supply, from the right side face of the V-phase, and from the left side face of the W-phase.



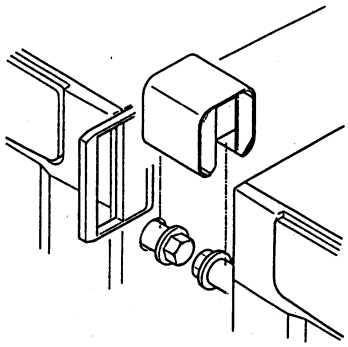


Use a coin or the like to unscrew a plug bolt.

Step 3 Attach the bolts, washers, and collars provided, to the places where the plug bolts have been removed.



Step 4 Using the joint holders provided, couple the V-phase power supply to the U-phase and the W-phase power supply to the U-phase.



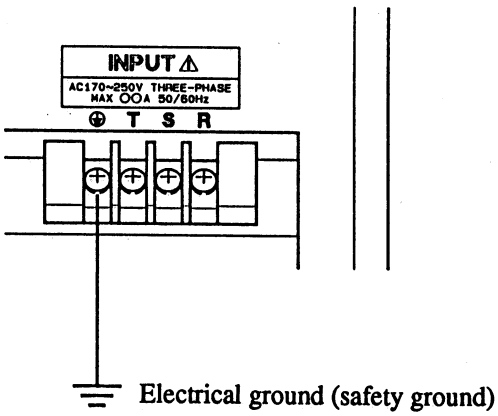
2.4 Checking the Input Power

O Always use input power at the rated input voltage and rated input frequency ranges.
- Rated input voltage range: 170 to 250 V
- Rated input frequency range: 50/60 Hz (47 to 63 Hz)

Caution
- *Use of the equipment outside of the above ranges may cause a problem.*

2.5 Grounding

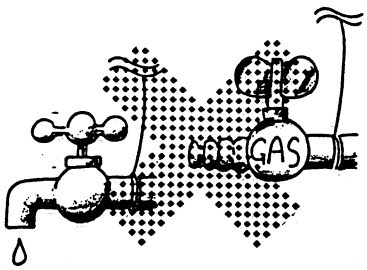
Always ground the equipment securely.



Electrical ground (safety ground)

O Always connect terminal ⏚ on the equipment's INPUT terminal board to a dedicated grounding terminal (GND) by using the provided cable.

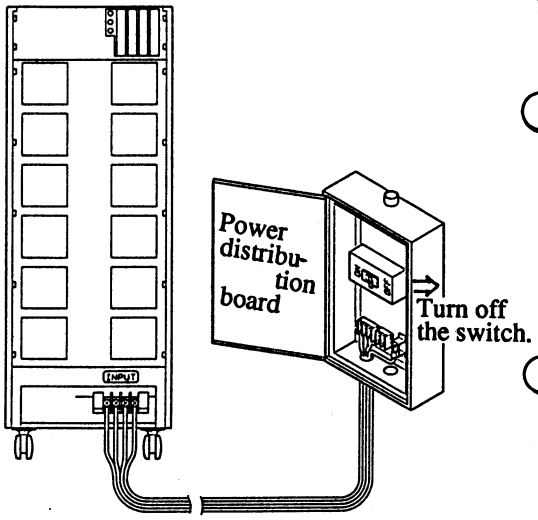
WARNING
- *If no grounding is provided, an electrical shock may be caused.*
- *Connect a grounding wire to an electrical ground (safety ground), or in compliance to the grounding requirements called for by the Electrical Codes and Regulations applicable in your area.*



Caution
- *If no grounding is provided, a malfunction may result from external noise and/ or the equipment may generate greater noise.*

2.6 Moving Precautions

When moving this equipment, exercise care as follows:

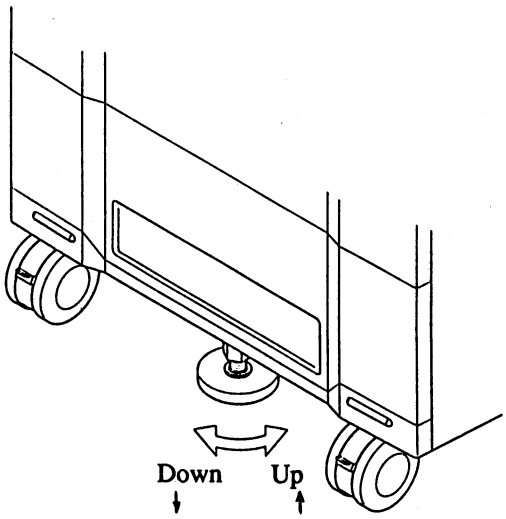


O Disconnect all the connected cables from the equipment.

WARNING
- *Before removing an input power cable, always cut off power feed from the power distribution board.*
- *Even if the equipment's POWER switch is turned OFF, voltage is still live at the input terminals, which is dangerous.*

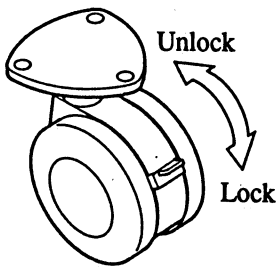
Caution

For PCR12000LT
- Disconnect all cables between the U-, V-, and W-phase power supplies.
- Remove the joint holders between the U- and V-phase power supplies and the U- and W-phase power supplies.

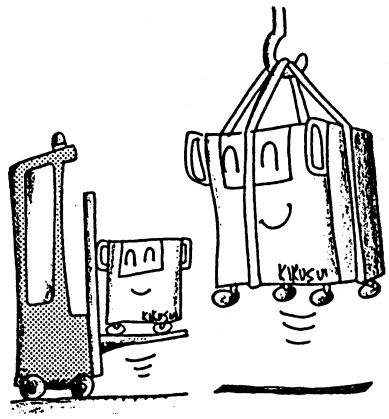


O Raise the bottom stopper to the upper limit to release the casters.
- The stopper is raised by turning it counterclockwise as viewed from above or lowered by turning clockwise.
- The stopper can be turned using a slight force since it is not locked to the ground.
- After the equipment is moved, turn the stopper clockwise until the equipment is fixed.

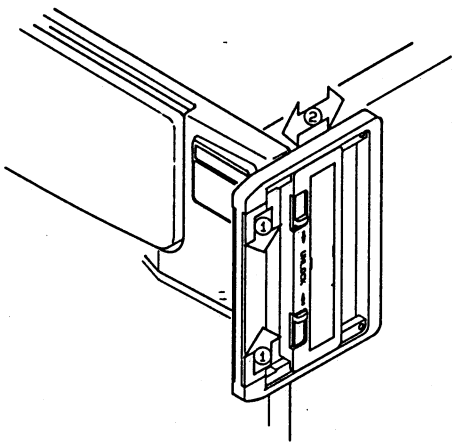
Caution
- *Before moving the equipment, always raise the stopper.*



Caution
- *Before moving the equipment, always unlock the casters. Otherwise, the equipment will not move smoothly because of friction in the wheels.*



How to Handle the Grips



- **Move the equipment across a flat surface whenever possible, and exercise great care in moving the equipment across a slope or step.**
- Always use two or more personnel to lift up the equipment.
- Hold the equipment from the bottom.
- Check the equipment weight beforehand.
- The equipment weight is indicated at the lower rear of the equipment.
- When using a forklift to move the equipment, place the fork underneath the equipment and confirm all safety conditions before lifting.
- When lifting the equipment with a crane using lifting bands, always apply the bands at the equipment bottom and confirm all safety conditions before lifting.
- Before lifting the equipment with a folklift or crane, always disconnect all cables and remove the joint holders between the U-, V-, and W-phase power supplies, then lift each piece of equipment individually.

WARNING

- *Do not use the handgrips to lift equipment. The grips are provided only for moving the equipment across a flat surface and will not support the equipment's weight.*

① To shift a grip, simultaneously slide two locks to the UNLOCK direction.

② Pull a grip toward you or push it forward until you hear a clicking sound.

Chapter 3

WIRING AND CONNECTING THE INPUT POWER BETWEEN THE U-, V-, AND W-PHASE POWER SUPPLIES

Faulty use of this equipment may result in electrical shock or fire since it handles high voltage and power. Always prepare the equipment in accordance with this chapter.

Contents

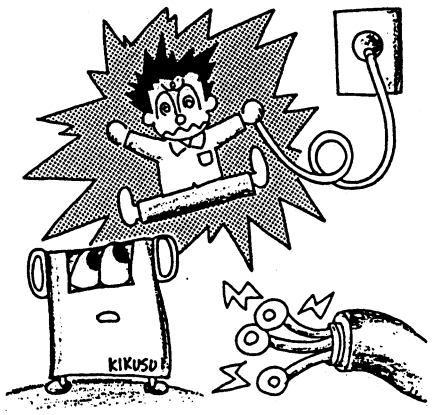
(Caution)

Before proceeding to preparation work, carefully read Chapter 2, INSTALLATION and perform the following:

- *Check the input power*
- *Provide grounding*

(WARNING)

- *Before connecting the input power cable to the input power source (power distribution board), always connect the input power cable to the equipment first. If the input power cable to the input power source is connected first, an electrical shock or short circuit may result.*

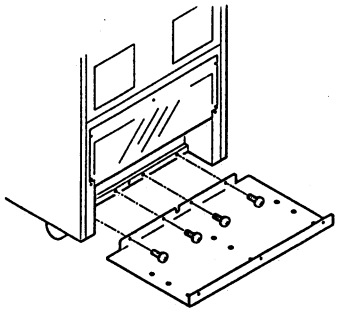


3.1 Wiring between the U-, V-, and W-Phase Power Supplies (PCR12000LT Only)

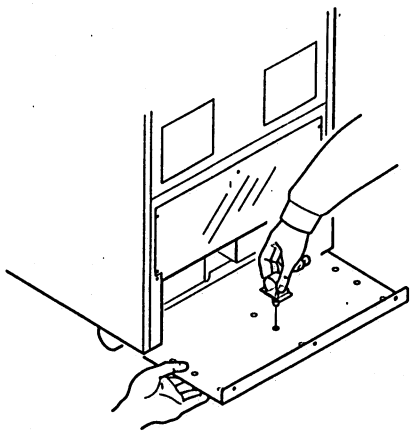
The PCR12000LT AC Power Supply is provided with sixteen cables, No. ① to No. ⑯. Firmly connect them in accordance with the following steps.

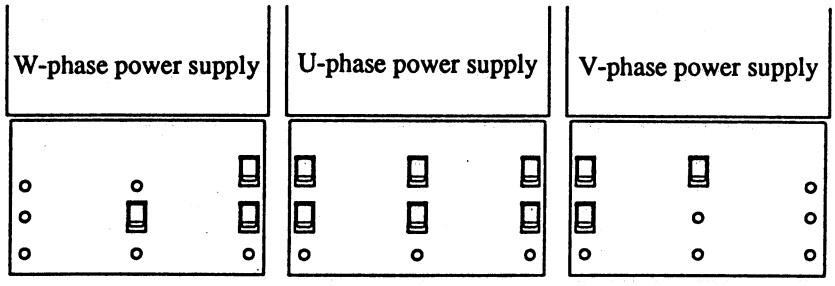
(Caution) *Erroneous or incomplete wiring may cause the equipment to fail.*

Step 1 Install the provided duct base on the U-, V-, and W-phase power supplies.



Step 2 Install the provided single-touch clampers onto the duct by referring to the figure below.

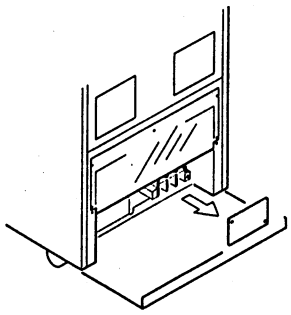




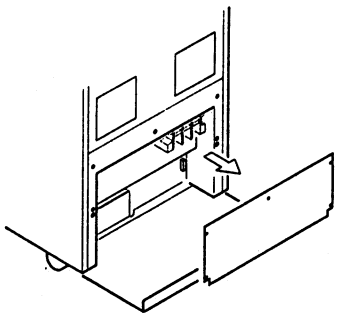
3.1.1 Wiring Power Cables between the U- and W-Phase Power Supplies

(Caution) *Erroneous or incomplete wiring may cause the equipment to fail.*

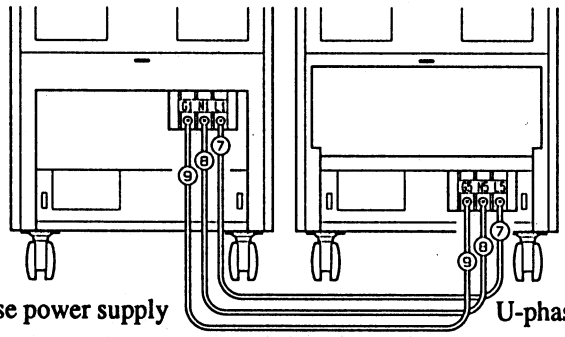
Step 1 Remove the cover from the terminal board at the lower right of the terminal box which is at the rear of the U-phase power supply.



Step 2 Remove the upper cover of the rear terminal box of the W-phase power supply.



Step 3 Securely connect the provided No. ⑦ to No. ⑨ cables (power connection cables) according to the figure and table below.



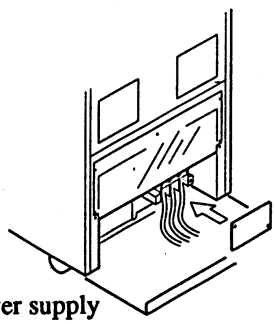
W-phase power supply U-phase power supply

U-phase power supply terminal board indication	W-phase power supply terminal board indication	Cable number (terminal cap color)
L5	L1	No. ⑦ (black)
N5	N1	No. ⑧ (white)
G5	G1	No. ⑨ (green)

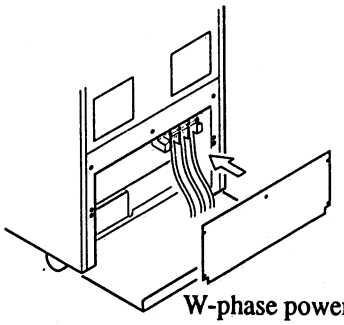
Caution

- *Tighten terminal screws securely. Improper tightening of terminal screws may result in cable disconnection or overheating at the connection, which is dangerous.*
- *Do not connect a power connection cable to other terminals. Otherwise, the equipment may become defective.*

Step 4 Install the covers removed in steps 1 and 2.

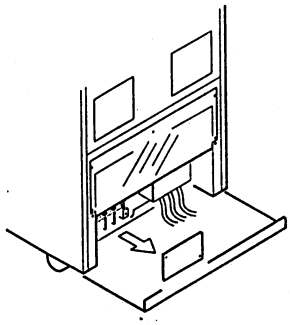


U-phase power supply

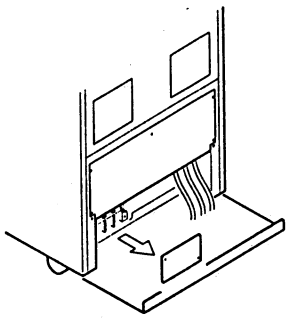


W-phase power supply

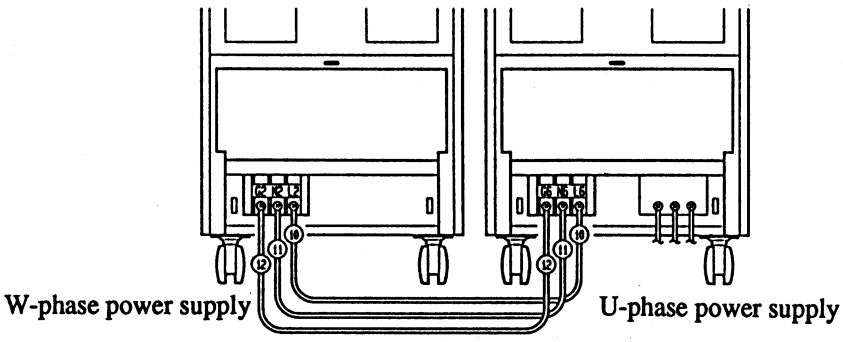
Step 5 Remove the cover from the terminal board at the lower left of the terminal box which is at the rear of the U-phase power supply.



Step 6 Remove the cover from the terminal board at the lower left of the terminal box which is at the rear of the W-phase power supply.



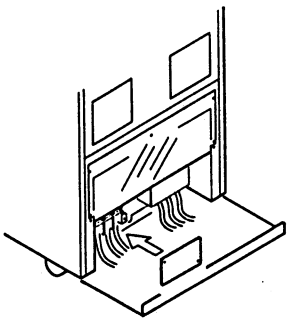
Step 7 Securely connect the provided No. ⑩ to No. ⑫ cables (power connection cables) according to the figure and table below.

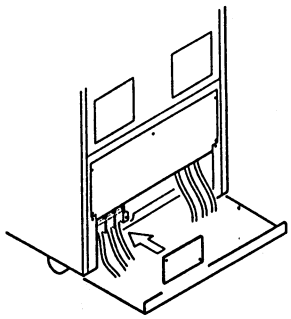


U-phase power supply terminal board indication	W-phase power supply terminal board indication	Cable number (terminal cap color)
L6	L2	No. ⑩ (black)
N6	N2	No. ⑪ (white)
G6	G2	No. ⑫ (green)

Caution
- *Tighten terminal screws securely. Improper tightening of terminal screws may result in cable disconnection or overheating at the connection, which is dangerous.*
- *Do not connect a power connection cable to other terminals. Otherwise, the equipment may become defective.*

Step 8 Install the covers removed in steps 5 and 6.

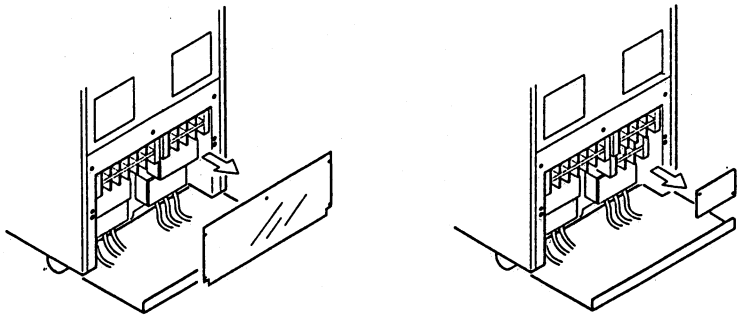

U-phase power supply


W-phase power supply

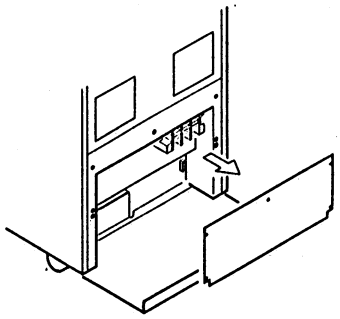
3.1.2 Wiring Power Cables between the U- and V-Phase Power Supplies

(Caution) *Erroneous or incomplete wiring may cause the equipment to fail.*

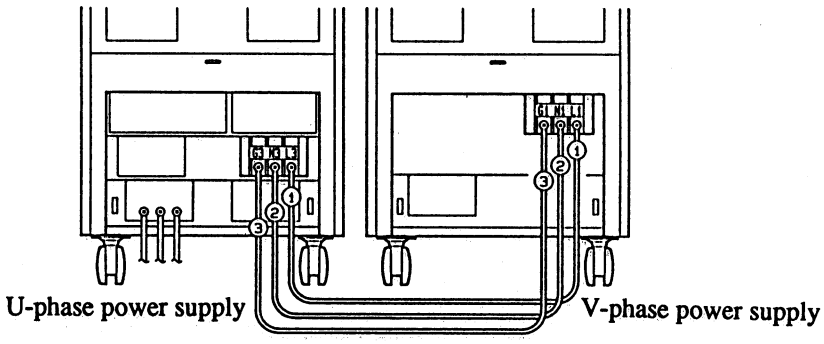
Step 1 Remove the cover from the upper part of the terminal box at the rear of the U-phase power supply and the cover from the terminal board at the middle right of the terminal box.



Step 2 Remove the upper cover of the rear terminal box of the V-phase power supply.



Step 3 Securely connect the provided No. ① to No. ③ cables (power connection cables) according to the figure and table below.

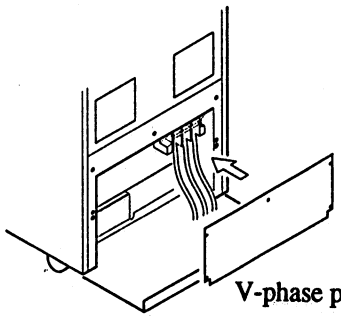


U-phase power supply terminal board indication	V-phase power supply terminal board indication	Cable number (terminal cap color)
L3	L1	No. ① (black)
N3	N1	No. ② (white)
G3	G1	No. ③ (green)

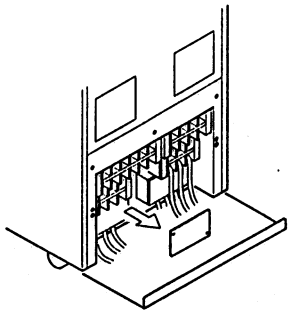
Caution

- *Tighten terminal screws securely. Improper tightening of terminal screws may result in cable disconnection or overheating at the connection, which is dangerous.*
- *Do not connect a power connection cable to other terminals. Otherwise, the equipment may become defective.*

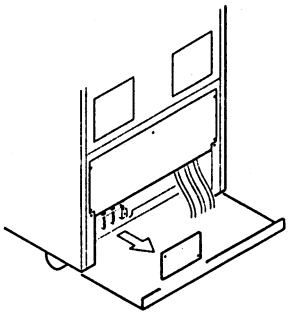
Step 4 Install the cover removed in step 2.



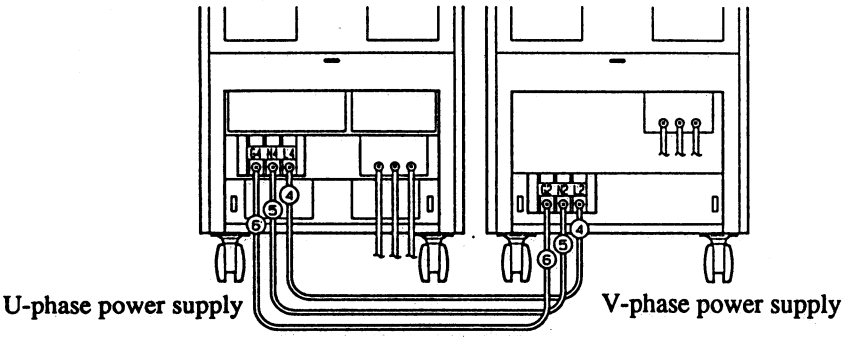
Step 5 Remove the cover from the terminal board at the middle left of the terminal box which is at the rear of the U-phase power supply.



Step 6 Remove the cover from the terminal board at the lower left of the terminal box which is at the rear of the V-phase power supply.



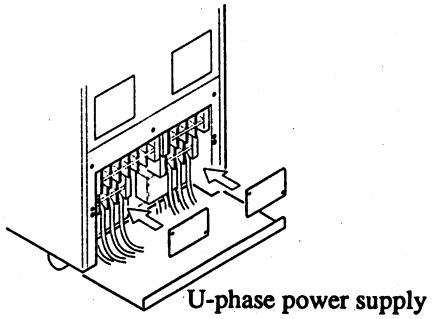
Step 7 Securely connect the provided No. ④ to No. ⑥ cables (power connection cables) according to the figure and table below.

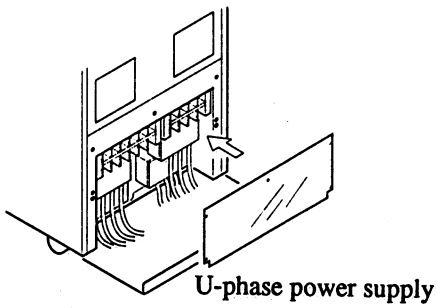


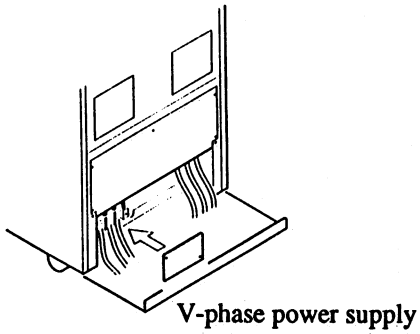
U-phase power supply terminal board indication	V-phase power supply terminal board indication	Cable number (terminal cap color)
L4	L2	No. ④ (black)
N4	N2	No. ⑤ (white)
G4	G2	No. ⑥ (green)

Caution
- *Tighten terminal screws securely. Improper tightening of terminal screws may result in cable disconnection or overheating at the connection, which is dangerous.*
- *Do not connect a power connection cable to other terminals. Otherwise, the equipment may become defective.*

Step 8 Install the covers removed in steps 1, 5 and 6.

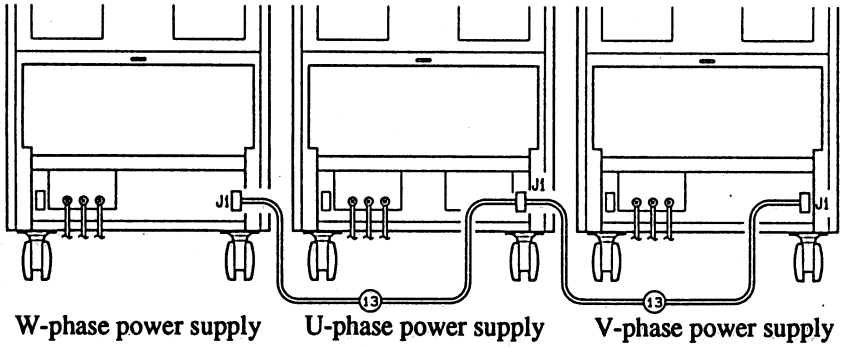






3.1.3 Wiring the Power Supply Conneciton Cables and Signal Cables

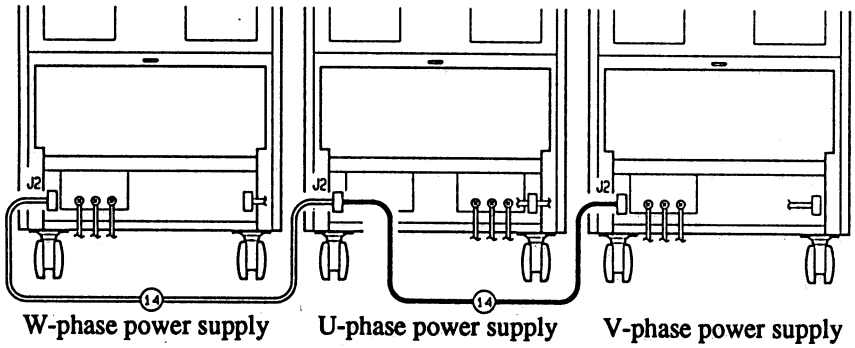
Step 1 Using the No. ⑬ cable (power supply connection cable) provided, connect the J1 terminal at the lower right of the terminal box in back of the U-phase power supply to the J1 terminal at the lower right of the terminal box in back of the V- and W-phase power supplies.



Caution • *Firmly insert the connectors until they are locked.*

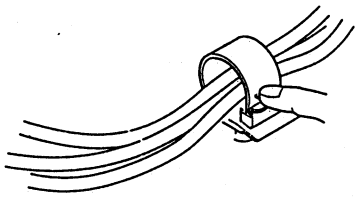
Step 2 Using the No. ⑭ cable (power supply connection cable) provided, connect the J2 connector at the lower left of the terminal box in back of the U-phase power supply to the J2 connector at the lower left of the terminal box in back of the V- and W-phase power supplies.

- Connect the black cable to the V-phase power supply and the white cable to the W-phase power supply.

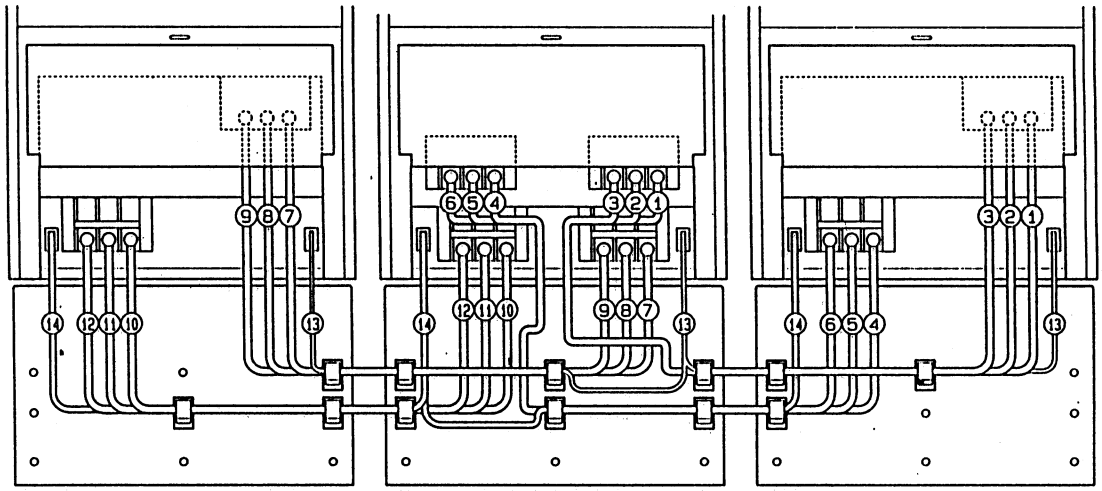


Caution
- *Firmly insert the connectors until they are locked.*
- *Be very careful to connect these cables to the V- and W-phase power supplies correctly. Otherwise, the equipment may become defective.*

Step 3 Securely clamp the No. ① to No. ⑫ cables (power connection cables) and No. ⑬ and No. ⑭ cables (power supply connection cables) to the single-touch clampers on the duct.

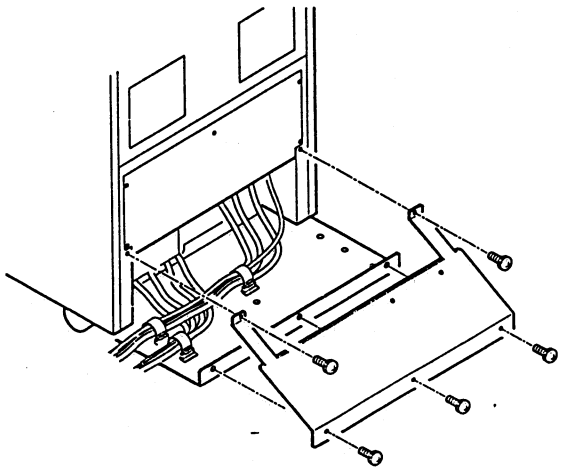


Confirm that the cables (No. ① to No.⑭) are correctly installed by checking against the figure below.



W-phase power supply U-phase power supply V-phase power supply

Step 4 Install the provided duct cover. The U-phase power supply has a dedicated duct cover (it is shaped differently).

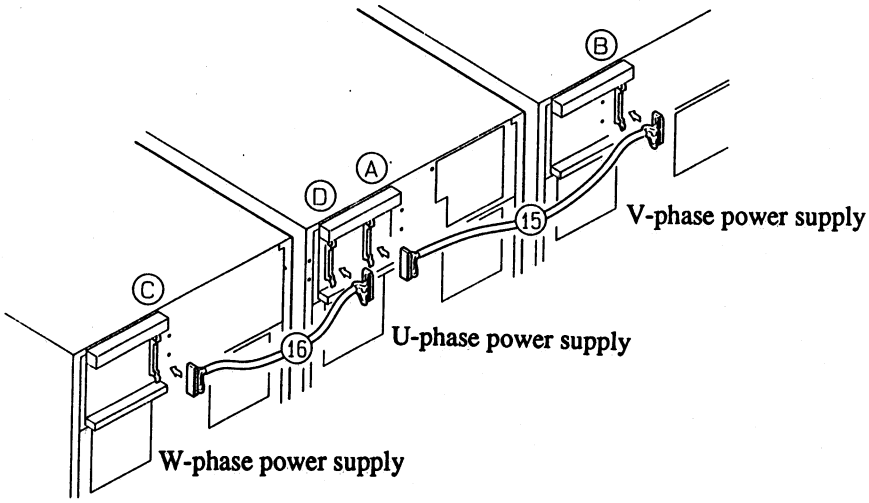


Step 5 Using the No. ⑮ cable (SIG cable) provided, connect the 3P-V DRIVE SIG OUT connector located in the upper rear of the U-phase power supply to the DRIVE SIG IN connector at the upper rear of the V-phase power supply.

- Connect the connector of the cable with indication "A" on the cable to the U-phase power supply, the connector with indication "B" to the V-phase power supply.

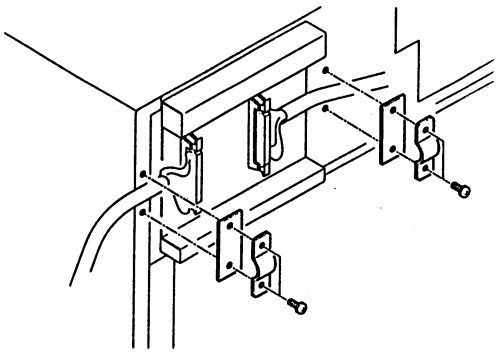
Using the No. ⑯ cable (SIG cable) provided, connect the 3P-W DRIVE SIG OUT connector at the upper rear of the U-phase power supply to the DRIVE SIG IN connector at the upper rear of the W-phase power supply.

- Connect the connector of the cable with indication "D" on the cable to the U-phase power supply, the connector with indication "C" to the W-phase power supply.

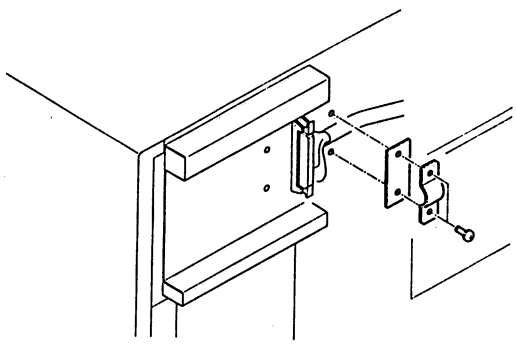


Caution *Firmly insert the connectors until they are locked.*

Step 6 Firmly fix the No. ⑮ and No. ⑯ cables using the provided SIG cable clampers.



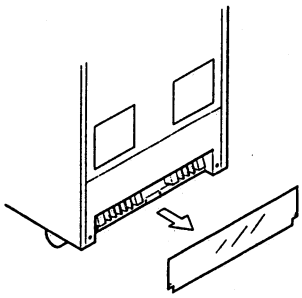
U-phase power supply



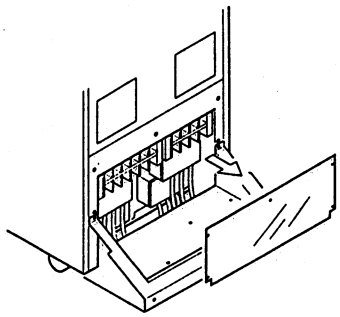
V-, W-phase power supplies

3.2 Connecting the Input Power

Step 1 Remove the rear terminal box cover from the equipment.



PCR6000LT

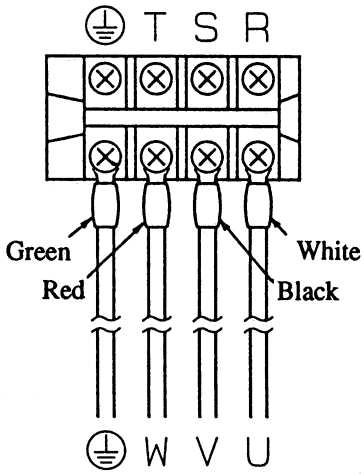


PCR12000LT

Step 2 Securely connect the crimp-style terminals of the provided input power cables to the INPUT terminal board in accordance with the table and figure below.

INPUT terminal board indication	Terminal cap color	Power distribution board
R	White	U
S	Black	V
T	Red	W
⏚ (GND)	Green	⏚ (GND)

[INPUT terminal board side]



[Power distribution board side]

Caution
- *Tighten terminal screws securely. Improper tightening of terminal screws may result in cable disconnection or overheating at the connection, which is dangerous.*
- *Do not connect the input power cable to the OUTPUT terminal board. Otherwise, the equipment may become defective.*

Step 3 Securely connect the other side of the input power cables connected to the equipment in step 2 to the input power source.

Caution
- Securely connect the cables by matching the cable cap colors specified in the table in step 2 to terminals U, V, W and ⏚ (GND) of the power distribution board.
- The power distribution board side of the input power cables is not provided with terminals.

- Attach crimp-style terminals, that match the terminal screws of the power distribution board to be connected to the input power cables and securely connect the cables (this work must be performed by qualified personnel).
- If the polarity (U, V, W and ⏚) of the power distribution board is unknown, always have it inspected by a power distribution board installer or qualified personnel.
- If the input power cables provided cannot be used due to installation site, consult a qualified personnel and select wire size with reference to the table below.
- Always use appropriate crimp-style terminals on this equipment side.

The following table shows the correspondence between the wire size (nominal conductor cross-section) and the allowable current.

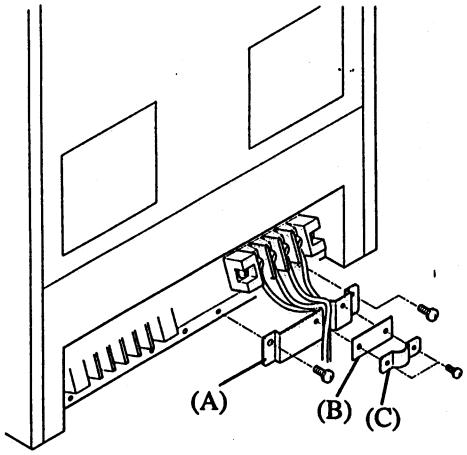
Wire size (mm^2)	Allowable current (A)	
	Maximum allowable temperature of insulator	
	60°C (140°F) use	75°C (167°F) use
0.75	8	13
1.25	11	17
2.0	15	23
3.5	21	34
5.5	28	45
8	36	56
14	51	80
22	67	105
38	96	150

The value in the table were obtained at 50°C (122°F).

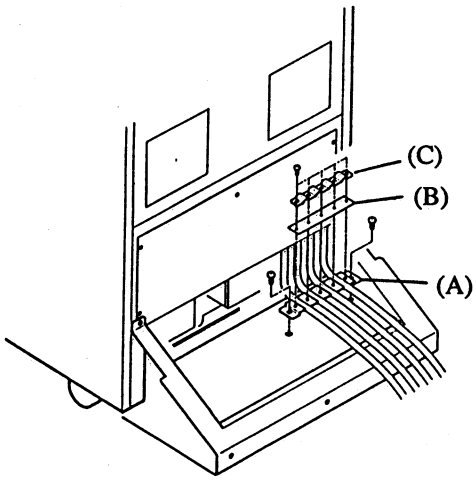
- The values in the above table are those of a single-core cable; they differ depending on the cable covering (insulator) and material (allowable temperature) used or multi-core cable. For cables other than those given in the above table, consult a qualified personnel.
- For a grounding ⏚ cable, use a cable whose size is equal to or greater than that of cables for the R, S and T terminals. A thin grounding cable may not be effective for preventing trouble.
- Check the current capacity of the input power (power distribution board). Insufficient current capacity may cause abnormally high temperatures at the input power source or may open a circuit breaker.

Step 4 Attach the provided cable clamper and securely fasten the input power cables on the clamper.

- Cable clamper parts and screws are also provided (in a PVC bag).
- Using the provided M4 screws, mount part (A) to the equipment.
- Lay the input power cables on the recessed sections of part (A).
- Using the provided M3 screws, fasten parts (B) and (C) onto part (A).



PCR6000LT



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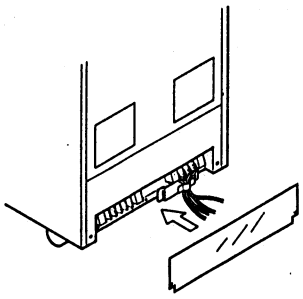
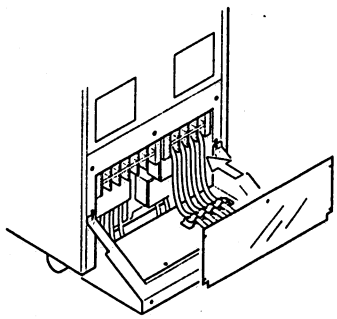
Caution

- If the cable clamper is not used to securely fix the input power cables to the equipment, application of excessive force to the INPUT terminal board may damage the terminal board or disconnect a cable wire, resulting in an electrical short or shock.
- If a cable other than the provided input power cables is used, the cable clamper may not fit such cable.

Step 5 Install the cover removed in step 1 to the terminal box.



PCR6000LT



PCR12000LT

Chapter 4
OPERATION CHECK

After connecting the input power cable by following the steps described through Chapter 3, conduct operation check as described in this chapter.

Contents

Operation check must be performed in any of the following.

- Purchasing the equipment
- Moving the equipment to a new location
- Using the equipment after it has not been used for a long period

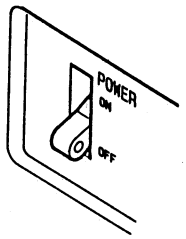
4.1 Power ON

After connecting the input power cable, check the following a) to d), then follow these steps, starting with step 1.

a) Check that the input power cable is correctly connected.
b) Check that no output cable is connected to the equipment OUTPUT terminal board.
c) Ensure that the terminal box cover is installed.

(Caution) *Conduct an operation check with nothing connected to the OUTPUT terminals and OUTPUT outlets of the equipment. Disconnect any load that is connected to an output.*

d) Ensure that the equipment POWER switch is OFF.

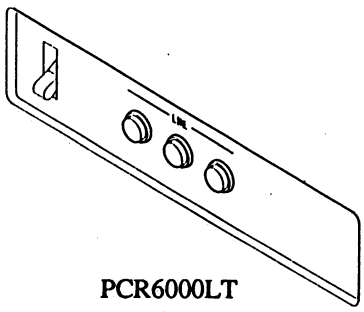


Power ON Operation Checking Procedure

Step 1 Turn ON the switch of the power distribution board to which the input power cables are connected, to feed power to the equipment.

Caution *If there is noise, a bad odor, fire, or smoke coming from the equipment when the power is fed, immediately turn OFF the power distribution board switch.*

Step 2 Check that the LINE lamp at the lower front part of the eqiupment is lit.
For the PCR12000LT AC Power Supplies, check that the LINE lamps of the U-, V-, and W-phase power supply (three pieces) are lit.



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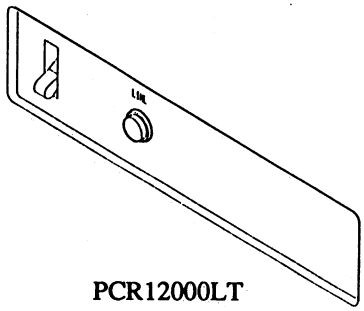

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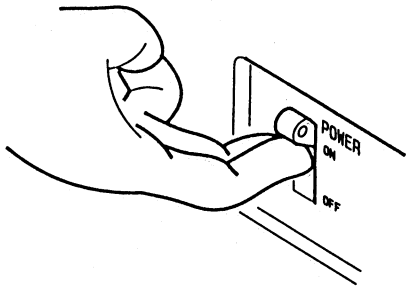
Caution *If all the LINE lamp does not light, turn OFF the power distribution board switch and re-check the input power cable connection. Then re-start the procedure from step 1. While doing so, keep the POWER switches of the equipment OFF.*
If a LINE lamp does not light even after the input power cables have been correctly connected, the power supply is probably faulty. Then turn the power distribution switch OFF and contact your Kikusui agent.

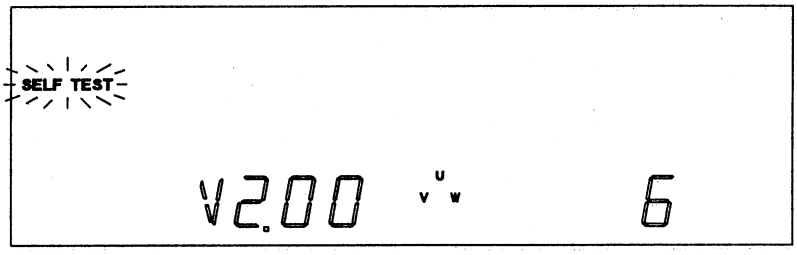
Step 3 Turn the equipment POWER switch ON.



Caution *If there is noise, a bad odor, fire, or smoke coming from the equipment when the power is fed, immediately turn OFF the power distribution board switch.*

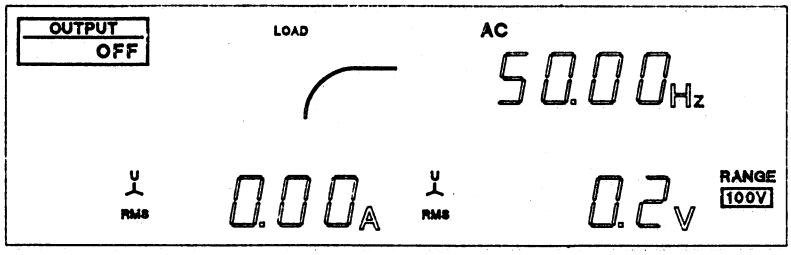
Step 4 Check that the control panel displays appear. All display examples hereafter refer to those of the PCR6000LT. (The display differs slightly by model.)

① The version is displayed for a few seconds. At this time, SELF TEST blinks. (The equipment is conducting an internal check.) The version is displayed as "V2.XX" (XX: numerics) in the current display area.



For more details, refer to 4.2, Version Check.

② If no error is detected by internal check, the display status proceeds to the Home Position.



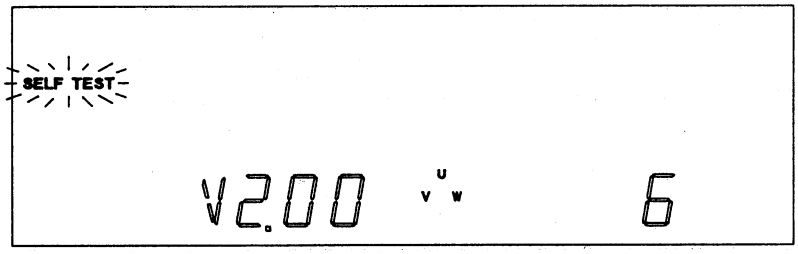
Caution
- *If ALARM lights after the self-test, an alarm has been triggered. See Chapter 9, PROTECTIVE FUNCTIONS AND THEIR OPERATIONS.*
- *If Err X (X: numeric) appears, see Chapter 9, PROTECTIVE FUNCTIONS AND THEIR OPERATIONS.*
- *Turning the POWER switch OFF and then ON again in rapid succession may cause problems. After turning the POWER switch OFF, wait for more than five seconds before turning it ON again.*
- *After the POWER switch is turned ON, all control panel indications may appear. If this status (all indications lit) continues for more than one minute, turn the POWER switch OFF. Wait for more than five seconds, then turn the switch ON.*

[Description] The status obtained immediately after turning the POWER switch ON is called the Home Position (regardless of OUTPUT ON/OFF status). To return to the Home Position from another status, press ESC.

If no error occurs after completing the above steps, the power ON operation check is complete.

4.2 Version Check

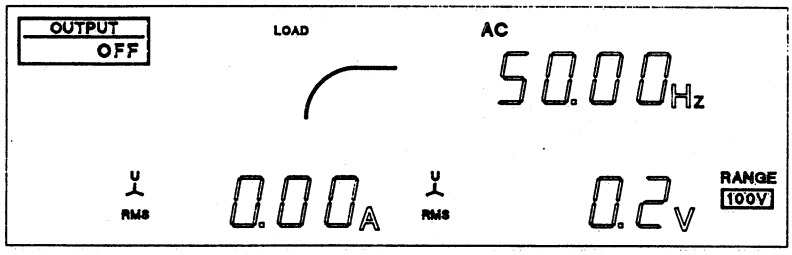
The equipment version is displayed on the control panel immediately after the POWER switch is turned ON. The version is indicated using "V" and numerics on the current display area. Other numerics are not related to the version. The following shows an example of the PCR6000LT version 2.00 display.



Caution *Turning the POWER switch OFF and then ON again in rapid succession may cause problems. After turning the POWER switch OFF, wait for more than five seconds before turning it ON again.*

4.3 Initial Setup Status

The status obtained when power is first fed to the equipment after purchase (factory shipment status) is called the Initial Setup Status. The figure below shows the control panel display in the Initial Setup Status.



The main settings in the Initial Setup Status are as follows:

- OUTPUT — OFF
- RANGE — 100 V
- Frequency — 50.00 Hz
- Voltage — 0.0 V
- Voltage display mode — U-phase RMS
- Current display mode — U-phase RMS

To call up the Initial Setup Status from another status, follow the reset procedure described below. A reset returns all settings to the Initial Setup Status.

Reset Procedure

Step 1 Turn the POWER switch ON to start from the Home Position.

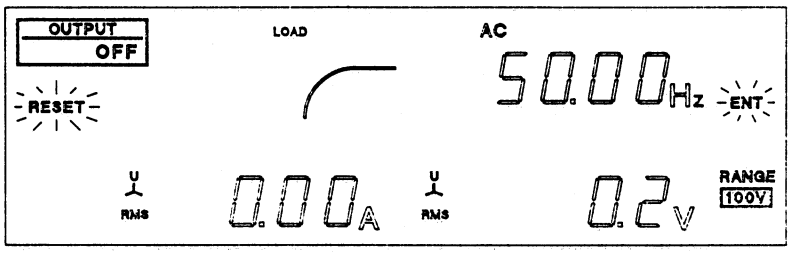
[Description] The status obtained immediately after turning the POWER switch ON is called the Home Position (regardless of the OUTPUT ON/OFF status). To return to the home position from another status, press ESC.

Step 2 Press SHIFT + 6 (RESET).

Shift key operation

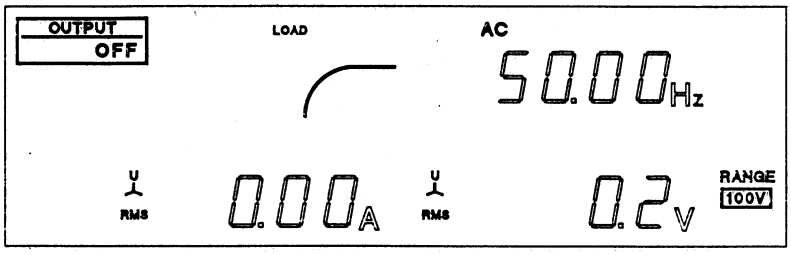
In this manual, key operations accompanied by pressing the SHIFT key are denoted as follows:
SHIFT + 6 (RESET) ..... Denotes that you should press SHIFT, which lights the SHIFT indication on the control panel, and then 6. (This selects the reset function.)

Step 3 The RESET and ENT indications on the control panel blink, waiting for ENT to be entered. Waiting for ENT, see "Description ENT Wait" in Chapter 6.



Pressing ESC in the above condition cancels a reset, returning the display status to the Home Position.

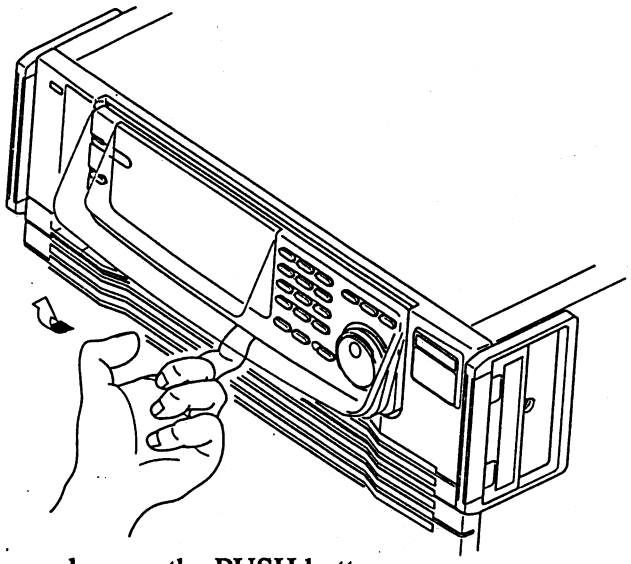
Step 4 Press SHIFT + ENT.
This causes the reset function to work, returning all settings to the Initial Setup Status.



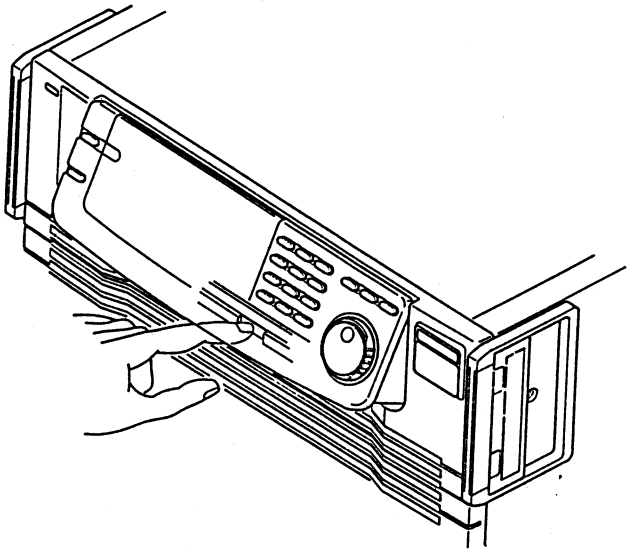
- SHIFT + ENT is a special key operation used only for the reset function. A reset returns all set values and memory data to the Initial Setup Status; a reset operation should not be easy to perform. Accordingly, a reset operation cannot be confirmed by simply pressing ENT, but requires SHIFT + ENT instead.

Description Control Panel Angle Adjustment

The control panel can be pulled out as shown below (in two steps).



To house the control panel, press the PUSH button.



4.4 Basic Operation Check

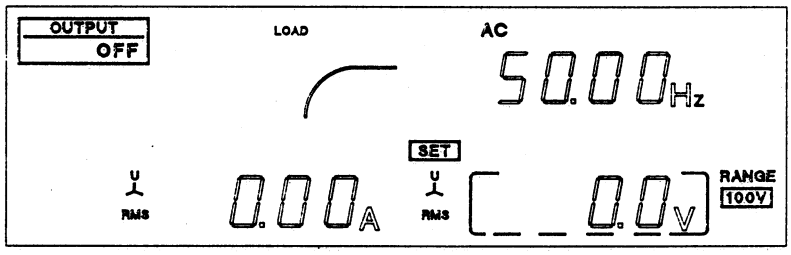
Caution

- *Carry out the basic operation check described in this section with nothing connected to the equipment outputs. If any load is connected to the equipment, always disconnect such load first. Also, read 4.1, Power ON, beforehand.*
- *If ALARM lights during the basic operation check, it indicates that an alarm has been triggered. See Chapter 9, PROTECTIVE FUNCTIONS AND THEIR OPERATIONS.*

Basic Operation Check Procedure

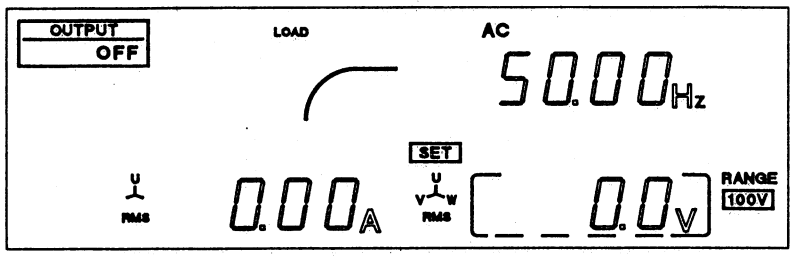
Step 1 Follow the reset procedure in 4.3, Initial Setup Status, to enter the equipment in the Initial Setup Status.

Step 2 Press "V" to call up the voltage setting mode.



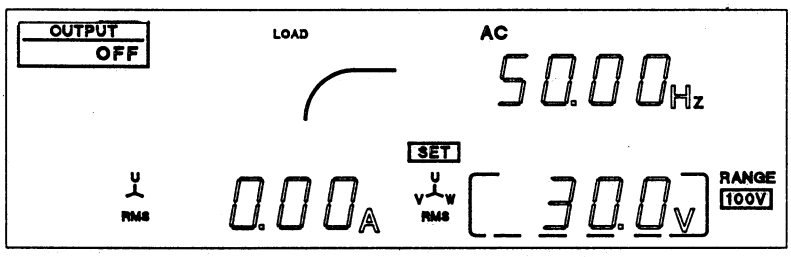
- This encloses the voltage display area with a yellow frame and lights SET.

Step 3 Press SHIFT + 2 (PHASE) to select the three-phase voltage setting mode.



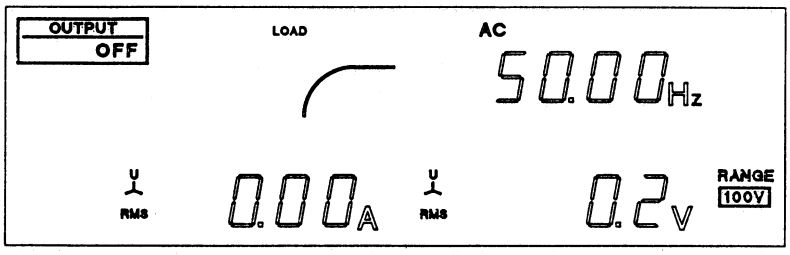
- This causes the ⅄ mark and the letters U, V, and W to appear at the left of the voltage display area.

Step 4 Turn JOG clockwise to set the voltage value to 30.0 V (you don't need to press the ENT).



- If the voltage value is increased by too much, turn JOG counterclockwise to reduce the voltage.

Step 5 Press ESC to exit the voltage setting mode.

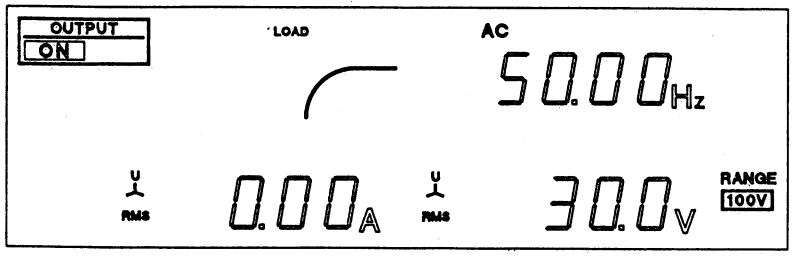


- SET goes off and only RMS is lit.
- The "30.0 V" voltage indication change to approximately 0 V.
- This status displays the U-phase output voltage rms.

Caution

- *If there is noise generation, a bad odor, fire, or smoke coming from the equipment, immediately turn OFF the equipment POWER switch.*

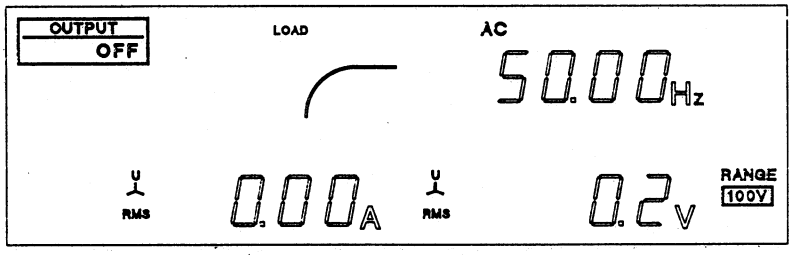
Step 6 Press OUTPUT once.
This causes "OUTPUT ON" to appear, and the voltage indication changes to 29.7 – 30.3 V.



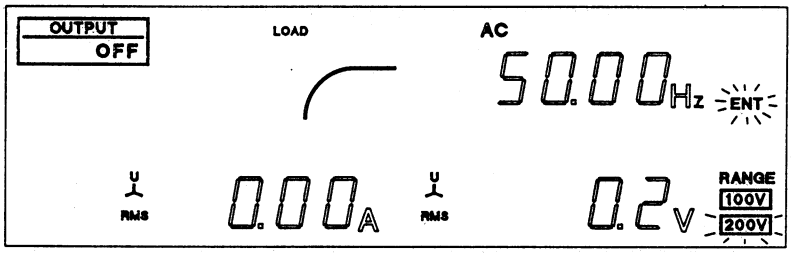
- In this status, 30 V is applied to the equipment OUTPUT terminal board.

Caution *If the voltage indication is abnormal in any steps, contact your Kikusui agent.*

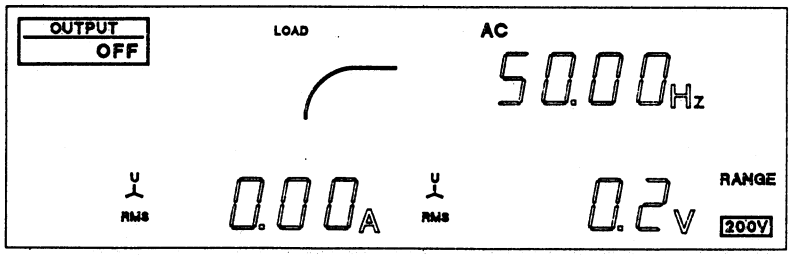
Step 7 Press OUTPUT once.
This causes "OUTPUT OFF" to appear, and the voltage indication changes to approximately 0 V.



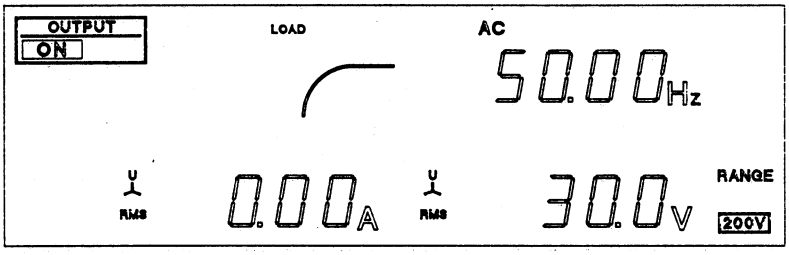
Step 8 Press SHIFT + 7 (RANGE).
This causes "ENT" and "200V" below RANGE to blink.



Step 9 Press ENT.
This causes "100V" below RANGE to go off and "200V" to light.

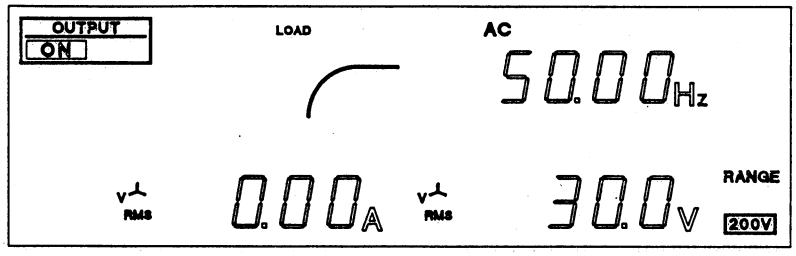


Step 10 Press OUTPUT once.
This causes "OUTPUT ON" to appear, and the voltage indication changes to 29.7–30.3 V.

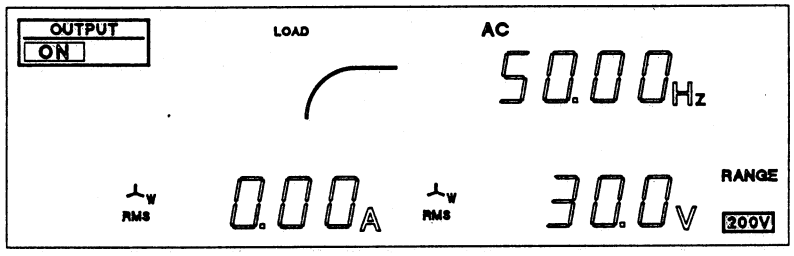


- In this condition, 30 V is applied to the equipment's OUTPUT terminal board.

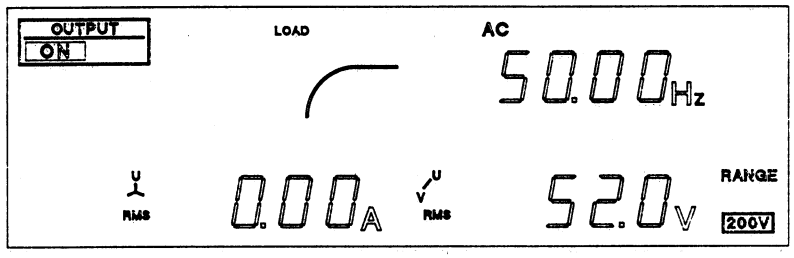
Step 11 Press SHIFT + 2 (PHASE) to display the V-phase voltage. The voltage indication value is 29.7–30.3 V.



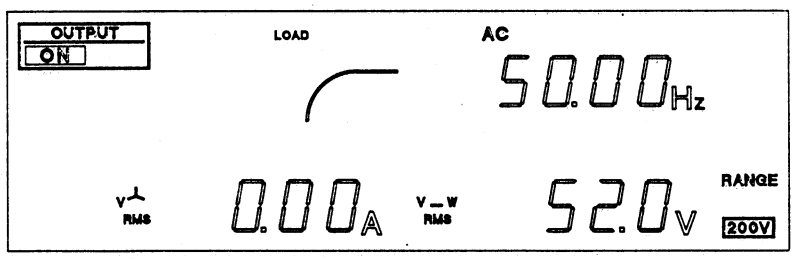
Step 12 Press SHIFT + 2 (PHASE) to display the W-phase voltage. The voltage indication value is 29.7–30.3 V.



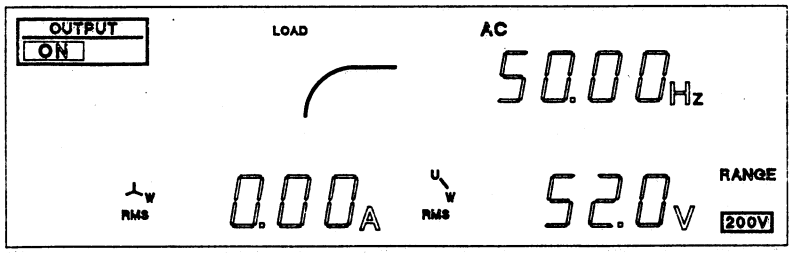
Step 13 Press SHIFT + 2 (PHASE) to display the U-to-V line voltage. The voltage indication value changes to 51.5–52.5 V



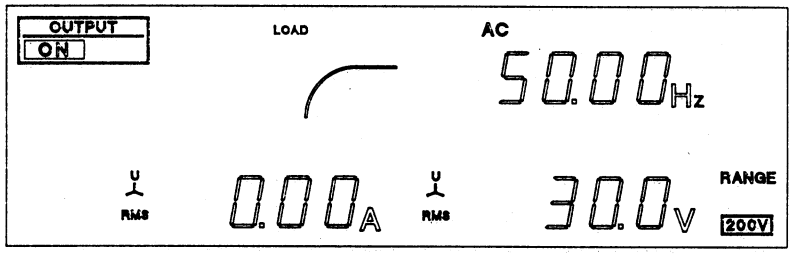
Step 14 Press SHIFT + 2 (PHASE) to display the V-to-W line voltage. The voltage indication value is 51.5–52.5 V.



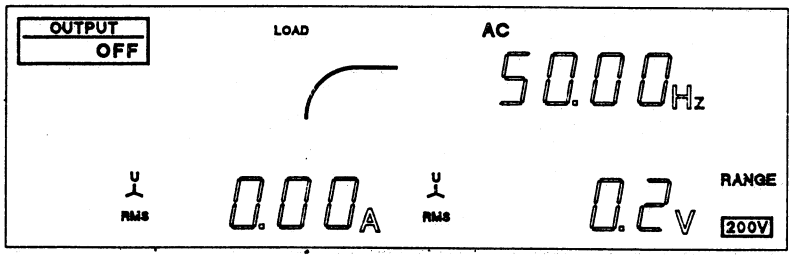
Step 15 Press SHIFT + 2 (PHASE) to display the W-to-U line voltage. The voltage indication value is 51.5–52.5 V.



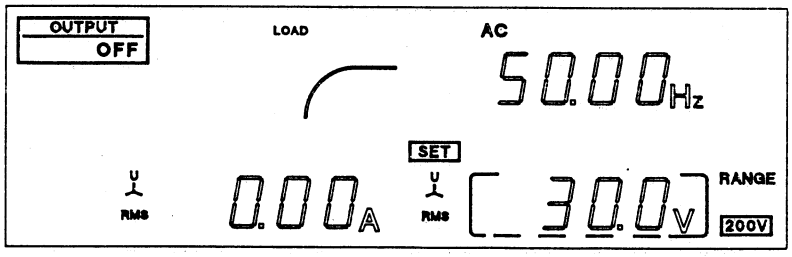
Step 16 Press SHIFT + 2 (PHASE) to display the U-phase voltage. The voltage indication value changes to 29.7–30.3 V.



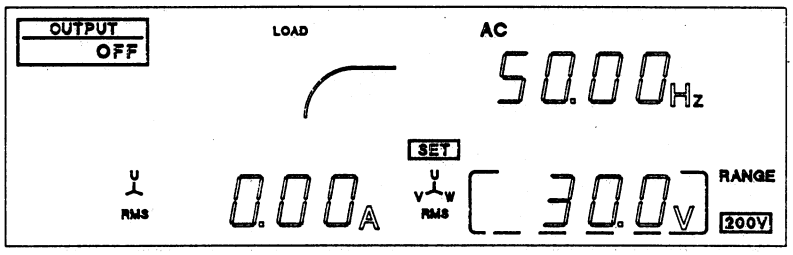
Step 17 Press OUTPUT once.
This causes "OUTPUT ON" to appear, and the voltage indication changes to approximately 0 V.



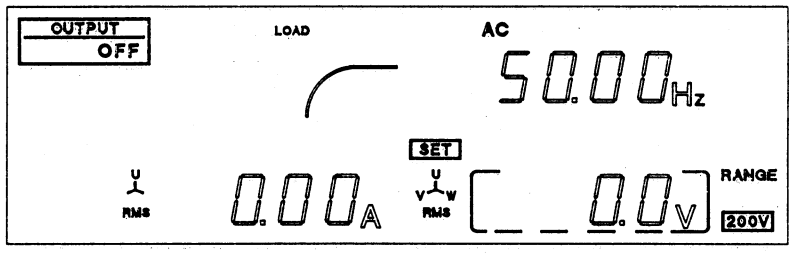
Step 18 Press "V" to call up the voltage setting mode.



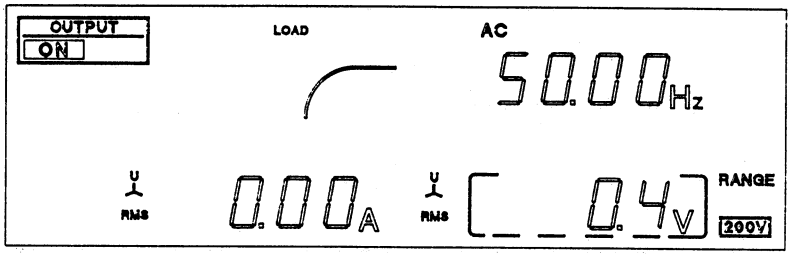
Step 19 Press SHIFT + 2 (PHASE) to select the three-phase voltage setting mode.



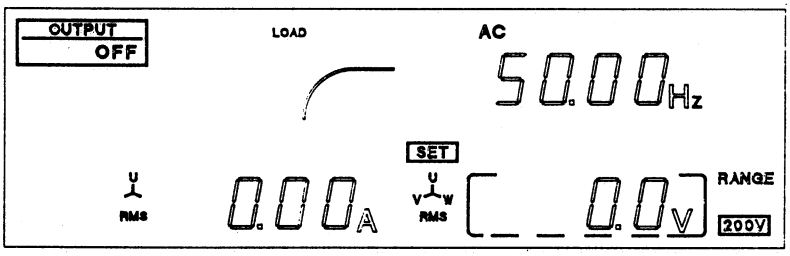
Step 20 Press "0" and "ENT" in that order.



Step 21 Press OUTPUT once.
This causes "OUTPUT ON" to appear, and the voltage indication changes to 0.0 – 0.8 V.

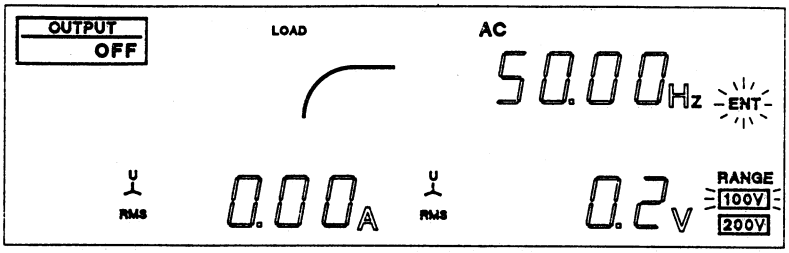


Step 22 Press OUTPUT once. This cause "OUTPUT OFF" to appear.

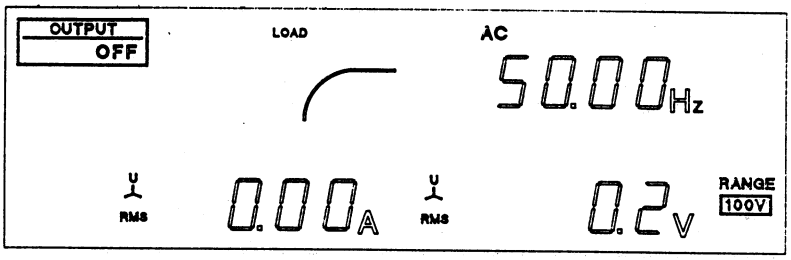


Step 23 Press ESC to exit the voltage setting mode.
This extinguishes "SET" and the yellow frame.

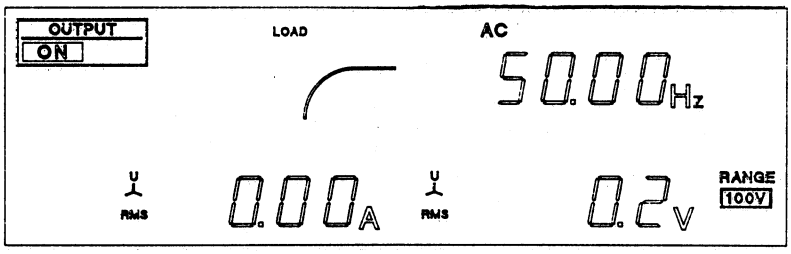
Step 24 Press SHIFT + 7 (RANGE).
This causes "ENT" and "100V" below RANGE to blink.



Step 25 Press ENT.
This causes "200V" below RANGE to go off and "100V" to light.



Step 26 Press OUTPUT once.
This causes "OUTPUT ON" to appear, and the voltage indication changes to 0.0 – 0.5 V.



Step 27 Press OUTPUT once. This causes "OUTPUT OFF" to appear.

This completes the basic operation check. The next page shows a list of the basic operation check steps. This basic operation check enables you to confirm whether the equipment's main functions are operating normally.

Caution • *Before proceeding to the next operation, always turn OFF the POWER switch.*

A List of Basic Operation Check Steps

Step	Operation	Checking content	Check
1	Call up the Initial Setup Status.	See 4.3 Initial Setup Status.	
2	Press "V."	The voltage display area is enclosed within a yellow frame.	
3	Press SHIFT + 2 (PHASE).	Causes ⅄ to appear at the left of the voltage display area.	
4	Turn JOG to set 30.0 V		
5	Press ESC.		
6	Press OUTPUT (to activate OUTPUT ON).	Voltage indication: 29.7 to 30.3 V	
7	Press OUTPUT (to activate OUTPUT OFF).	Voltage indication: Approx. 0 V	
8	Press SHIFT + 7 (RANGE).	ENT and "200V" blink.	
9	Press ENT.	"100V" goes off and "200V" lights.	
10	Press OUTPUT (to activate OUTPUT ON).	Voltage indication: 29.7 to 30.3 V (U-phase voltage)	
11	Press SHIFT + 2 (PHASE).	Voltage indication: 29.7 to 30.3 V (V-phase voltage)	
12	Press SHIFT + 2 (PHASE).	Voltage indication: 29.7 to 30.3 V (W-phase voltage)	
13	Press SHIFT + 2 (PHASE).	Voltage indication: 51.5 to 52.5 V (U-to-V line voltage)	
14	Press SHIFT + 2 (PHASE).	Voltage indication: 51.5 to 52.5 V (V-to-W line voltage)	
15	Press SHIFT + 2 (PHASE).	Voltage indication: 51.5 to 52.5 V (W-to-U line voltage)	
16	Press SHIFT + 2 (PHASE).	Voltage indication: 29.7 to 30.3 V (U-phase voltage)	
17	Press OUTPUT (to activate OUTPUT OFF).	Voltage indication: Approx. 0 V	
18	Press "V."	SET lights. Voltage indication: 30.0 V	
19	Press SHIFT + 2 (PHASE).	Causes ⅄ to appear at the left of the voltoge display area.	
20	Press "0" and "ENT" in that order.	Voltage indication: 0.0 V	
21	Press OUTPUT (to activate OUTPUT ON).	VOLTAGE indication: 0.0 to 0.8 V	
22	Press OUTPUT (to activate OUTPUT OFF).	Voltage indication: Approx. 0 V	
23	Press ESC.		
24	Press SHIFT + 7 (RANGE).	ENT and "100V" blink.	
25	Press ENT.	"200V" goes off and "100V" lights.	
26	Press OUTPUT (to activate OUTPUT ON).	Voltage indication: 0.0 to 0.5 V	
27	Press OUTPUT (to activate OUTPUT OFF).	Operation check is complete.	

Chapter 5
CONNECTING A LOAD

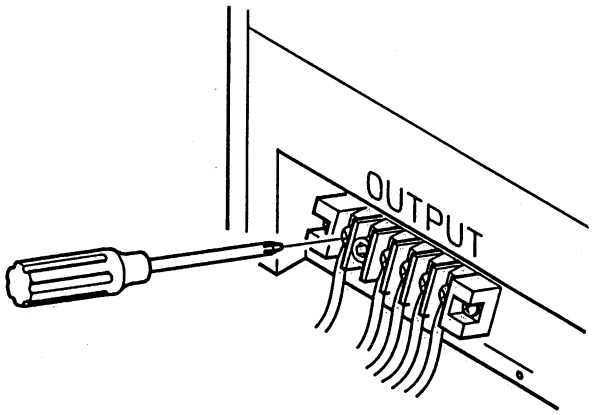
After completing the operation check in Chapter 4, connect a load in accordance with this chapter.

Contents

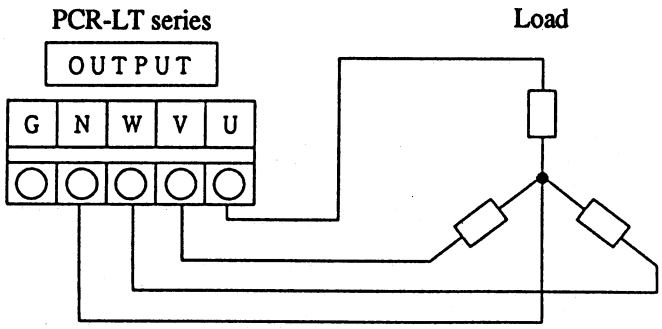
(WARNING) *Before connecting a load, turn the POWER switch OFF and cut off the power feed from the power distribution board.*

5.1 Connection to the OUTPUT Terminal Board

Securely connect the output cables from a load to the OUTPUT terminal board.



(Caution)
- *Output from the equipment uses a three-phase four-wire system (Y-connection, star connection); always connect the neutral point to terminal N on the OUTPUT terminal board of the equipment.*
- *Failure to provide the neutral point may prevent the rated power from being generated.*



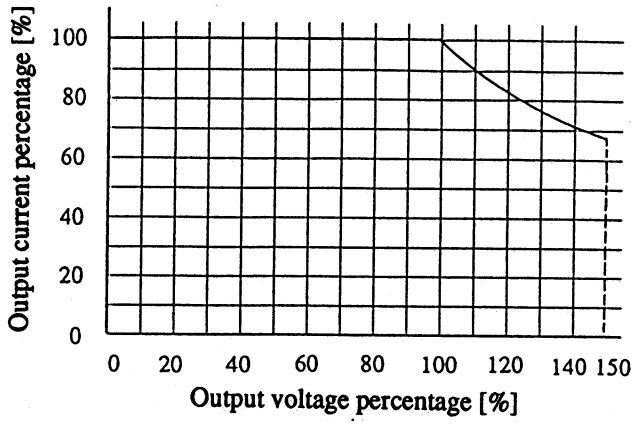
Terminals U, V, W, and N of the OUTPUT terminal board are isolated from input power; polarity differences cause no special safety problems. However, because polarity is concerned with output phase rotation or with synchronous mode (synchronization with input power), check the load polarity and then connect cables. Also, ground load cables at the N terminal.

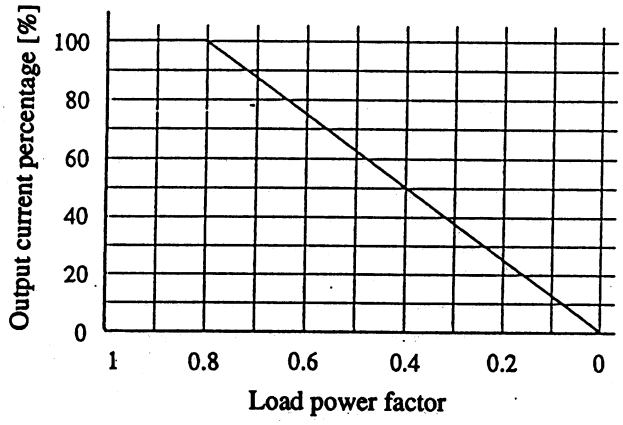
(Caution)
- *Select the conductor size of output cables based on Wire size and Allowable Current table shown in step 3 of Chapter 3.2.*
- *If a load has a grounding terminal (GND), always connect a grounding wire to terminal G of the equipment OUTPUT terminal board. In this case, the grounding cable should have a diameter greater than or equal to that of the output cables.*

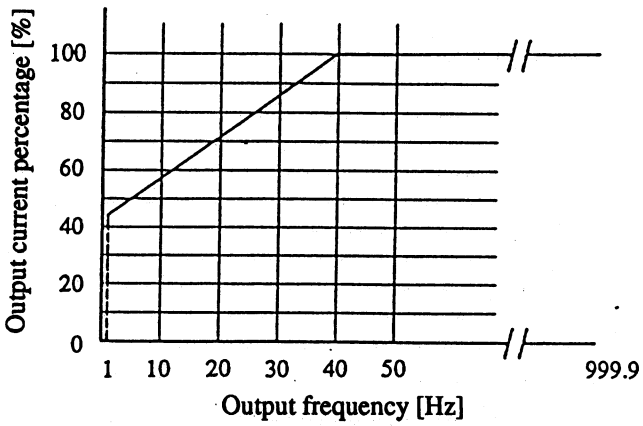
Description Output and Load of this Equipment

For linear loads

The rated AC output current obtained from the equipment is limited by the conditions of the equipment output voltage, load power factor, and output frequency, as shown in the graphs below.







The following describes two examples of how to obtain the rated output current for the PCR6000LT.

Example 1: Where output voltage is 115 V (100 V range), load power-factor 0.7, and output frequency 25 Hz.

- Output current percentage at 115 V output voltage : 87% ..... (a)
- Output current percentage at 0.7 load power factor : 87.5% ... (b)
- Output current percentage at 25 Hz output frequency : 78% ..... (c)

Based on conditions (a) and (b), output current percentage at 115 V output voltage and 0.7 load power-factor is (a) × (b) = 76.1 (%)
When this value is compared with (c), the value is lower than (c); the rated output current is limited by the value obtained by (a) × (b). Therefore, the maximum output current percentage is 76.1% obtained by (a) × (b).
For the PCR6000LT, since the output current available for 100% output current percentage in the 100 V output range is 20 A, the rated output current under the above conditions is 20 × 0.761 = 15.2 [A]

<table>
<tr><td></td><td colspan="3">Output current percentage [%]</td><td>Rated output current [A]</td></tr>
<tr><td>Output voltage : 115 V</td><td>(a) 87</td><td rowspan="2">(a) × (b) = 76.1</td><td rowspan="2">(a) × (b) < (c)

Select (a) × (b)</td><td rowspan="3">20 × 0.761 = 15.2</td></tr>
<tr><td>Load power factor : 0.7</td><td>(b) 87.5</td></tr>
<tr><td>Output frequency : 25 Hz</td><td>(c) 78</td><td></td></tr>
</table>

Example 2: Where output voltage is 240 V (200 V range), load power factor 0.65, and output frequency 15 Hz.

- Output current percentage at 240 V output voltage : 83% ..... (a)
- Output current percentage at 0.65 load power factor : 81% ..... (b)
- Output current percentage at 15 Hz output frequency : 64% ..... (c)

Based on the conditions (a) and (b), output current percentage at 240 V output voltage and 0.65 load power factor is (a) × (b) = 67.2 [%]
When this value is compared with (c), (c) is lower than the value; the rated output current is limited by the value of (c). Therefore, the maximum output current percentage is 64%. For the PCR6000LT, since the output current available for 100% output current percentage in the 200 V output range is 10 A, the rated output current under the above conditions is 10 × 0.64 = 6.4[A]

<table>
<tr><td></td><td colspan="3">Output current percentage [%]</td><td>Rated output current [A]</td></tr>
<tr><td>Output voltage : 240 V</td><td>(a) 83</td><td rowspan="2">(a) × (b) = 67.2</td><td rowspan="3">(a) × (b) > (c)

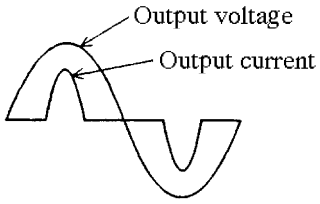
Select (c)</td><td rowspan="3">10 × 0.64 = 6.4</td></tr>
<tr><td>Load power factor : 0.65</td><td>(b) 81</td></tr>
<tr><td>Output frequency : 15 Hz</td><td>(c) 64</td><td></td></tr>
</table>

In this case, the LOAD level meter on the control panel indicates the limited output current of the phase which has the highest load ratio among the three, as full scale. Load ratio means the ratio of the load current value to the output current value.

If the equipment is used exceeding the condition of the rated output current noted above, the equipment protective function is activated, which may cause output voltage to droop or to be cut off altogether. For further information on the protective functions, see Chapter 9, PROTECTIVE FUNCTIONS AND THEIR OPERATIONS.

For loads having a capacitor-input-type rectifying circuit

When electronic devices having a capacitor-input-type rectifying circuit are used as loads for this equipment, a peak current a few times greater than the output current rms flows near the peak output voltage as the output current.



In this case, the maximum output peak current must not exceed four times of the maximum rated current (rated output capacity [VA]/100 [V] (for 100 V range) or rated output capacity [VA]/ 200 [V] (for 200 V range)).

Also, the output current rms should not exceed the rated output current value calculated when the load power-factor is 1 in the case of the liner load noted above.

If the equipment is used at a current exceeding the rated output current (peak or rms) noted above, the equipment's protective function is activated, which may distort the output voltage waveform or cut off the output. For further information on the protective functions, see Chapter 9, PROTECTIVE FUNCTIONS AND THEIR OPERATIONS.

However, the output voltage (set value) must be a constant voltage to supply the maximum peak current without distortion. It may distort the voltage waveform and current waveform to suddenly change (raise) the output voltage set value. In optional power line abnormality simulation and sequence operation, a change of output voltage may distort the waveform similarly. If the output voltage set value is a constant value in OUTPUT ON, the equipment can supply the maximum peak current without distortion.

For loads which draw a rush current

For loads noted below, a rush current (several to several tens of times greater than the normal current) may flow during several to several tens of cycles of output frequency when voltage is applied to such a load or when voltage changes suddenly.

- Transformers and slide transformers
  When voltage is applied to a transformer or slide transformer, a rush current of the maximum several tens to hundreds of times greater than the normal current may flow during several cycles depending on voltage application timing or the state of residual magnetism.

- Motors and lamps loads
  When voltage is applied to a motor or lamp loads, a rush current several to several tens of times greater than the normal current may flow during several tens to hundreds of cycles.

- For capacitor-input-type rectifying loads
  For electronic devices with a capacitor-input-type rectifying circuit in an power input block, if a protective (limiting) circuit against rush current is not provided, a rush current several tens to hundreds of times greater than the normal current may flow during several cycles.

This equipment is capable of feeding a maximum output peak current up to four times greater than the maximum output rms current for a capacitor-input-type rectifying load. For other loads, the equipment can supply an instantaneous peak current for about 1 second (this may differ depending on the current waveform, output voltage, and output frequency). For example, the instantaneous peak current that can be supplied when the output voltage is 100 V and output frequency 50 Hz is shown in the table below.

Load power factor	Instantaneous peak current percentage [%]
1	200
0.9	160
0.8	150
0.6	140
0.4	120
0.2	110

* The values in the table above show the output current percentage where the PCR-LT series maximum output current is regarded as 100%.

If a rush current exceeding the noted peak current flows, the equipment's protective function is activated, which may distort output voltage waveform or cut off the output. For further information on the protective functions, see Chapter 9, PROTECTIVE FUNCTIONS AND THEIR OPERATIONS.

For loads where surge occurs

Loads (such as a fluorescent lamp) subject to surges when voltage is applied to a load or when voltage changes suddenly may cause the equipment to malfunction. In such a case, install a noise filter in the output circuit.

For special loads

If a capacitor is directly connected to the OUTPUT terminal board, the output waveform may be distorted. In such cases, connect a capacitor to the load side of the output wiring.

For loads which have small saturation magnetic flux density

To implement a power supply simulation or other functions, DC amplifier is used in this equipment.
Therefore, DC offset voltage (about 100mV) may be superimposed on AC output.
If the load such as a transformer which has small saturation magnetic flux density is connected to the output, an excessive current may flow.

Chapter 6
OPERATION METHOD

Describes how to operate various functions of the equipment.

Contents

Description Home Position

The status obtained immediately after the POWER switch is turned ON is called the Home Position (regardless of OUTPUT ON/OFF). To return to the Home Position from another mode, press ESC.

Description Shift Key

When the SHIFT key is pressed, "SHIFT" on the control panel lights, and when the key is pressed again, "SHIFT" goes off.
Pressing a key when "SHIFT" is lit activates the function written in blue letters below the corresponding key.

Example: SHIFT + 4 (KEYLOCK)
☞ This indicates that SHIFT should be pressed, which lights "SHIFT" on the control panel, then "4" pressed. (This selects the key lock function.)

Description ENT Wait

The condition whereby ENT has not yet been pressed to initiate operations made thus far is called ENT wait. In this case, "ENT" on the control panel blinks. To cancel the operation before pressing ENT, press ESC.

6.1 Setting the Output Voltage Range (100 V/200 V)

The equipment has two output voltage ranges, a 100 V range and a 200 V range. This range can be selected as necessary. The equipment stores the output voltage range data. When the POWER switch is turned ON, the equipment starts up in the output voltage range applied immediately before the POWER switch was turned OFF.
The output voltage range is displayed on the control panel as follows:

100 V range: "100V" below RANGE lights.
200 V range: "200V" below RANGE lights.

Procedure for Switching the Output Voltage Range

The output voltage range can be switched from the 100 V range to the 200 V range or vice versa.

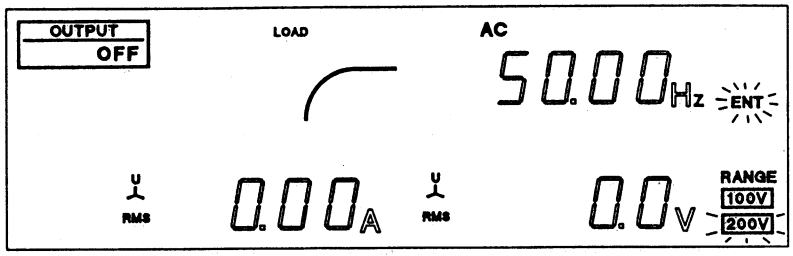
Step 1 When "OUTPUT ON" is lit, press OUTPUT to turn the output OFF.

Step 2 Press ESC to select the home position.

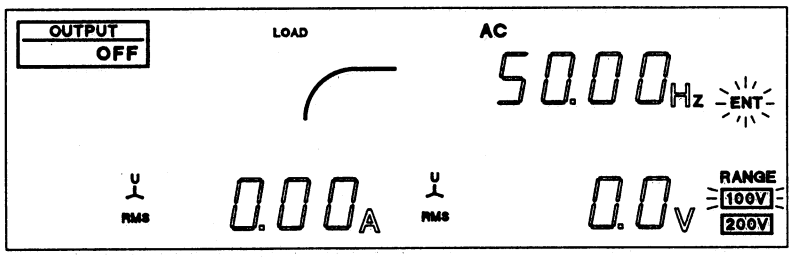
Step 3 Press **SHIFT + 7 (RANGE).**

- The control panel display changes as shown below depending on the existing output voltage range.

In the 100 V range: "100V" lights continuously and "200V" blinks.



In the 200 V range: "200V" lights continuously and "100V" blinks.



Step 4 Press **ENT** to establish the output voltage range.

- When the equipment was in the 100 V range, the 200 V range is selected, and when in the 200 V range, the 100 V range is selected.
- To cancel operation and return to the Home Position, press ESC during ENT wait (the status in which ENT blinks).
- The output voltage range can be changed only when OUTPUT is OFF in the Home Position.
- In the Initial Setup Status, the equipment is in the 100 V range.

[Description] The maximum output current value changes depending on the output voltage range. The maximum output current value for the 200 V range is half that of the 100 V range. Select the range after carefully checking the equipment specifications.

6.2 Output Voltage Setting

The equipment stores an output voltage value. When the POWER switch is turned ON, the equipment sets the output voltage value applied immediately before the POWER switch was turned OFF.

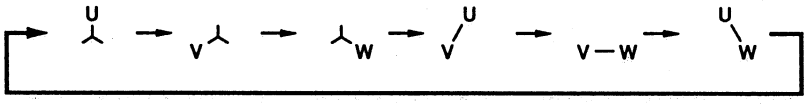
6.2.1 Phase Voltage Setting

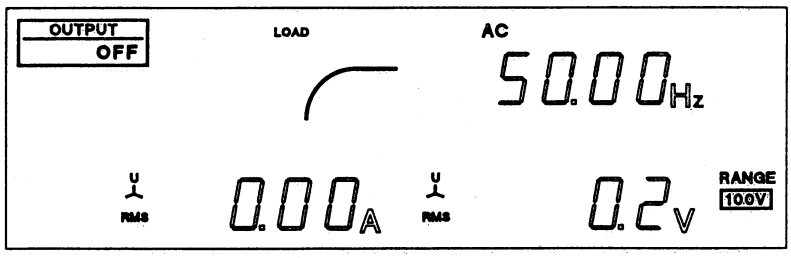
The equipment offers two methods for setting the phase voltage; individually setting each phase voltage or simultaneously setting three-phase voltage.

Setting individual phase voltages

Step 1 Press ESC to select the Home Position.

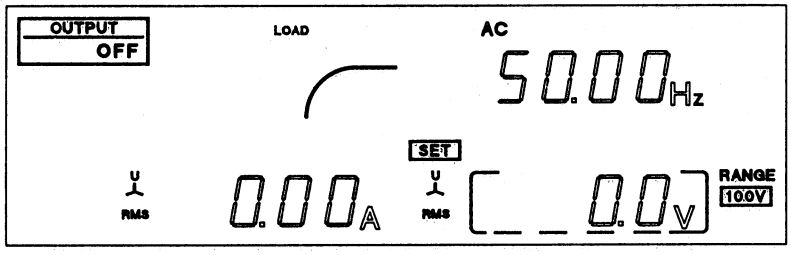
Step 2 Press SHIFT + 2 (PHASE) to select the phase voltage display mode.
Each time SHIFT + 2 (PHASE) is pressed, the voltage display mode changes as follows:





- The above example sets phase U.
  To set phase V, set the display so that the ⅄ mark and letter V are indicated; to set phase W, set it so that the ⅄ mark and letter W are indicated.

Step 3 Press "V" to enter the voltage setting mode.



- This causes the yellow frame that encircles the voltage display area to light, indicating that setting is possible.

Step 4 Set the output voltage.

- Using the numeric keys (0 to 9), enter a voltage value and press ENT to set it.

[Description] Entry using the numeric keys is possible when the output is OFF. When the output is ON, entry using the numeric keys is possible only when the "SET" is lit. In the voltage setting mode, voltage setting using JOG/SHUTTLE is always possible. For details, refer to Section 6.6, "How to Use JOG and SHUTTLE".

- To cancel operation during entry using the numeric keys and to return to step 2, press ESC or CLR during ENT wait.
- If an attempt is made to set a voltage that exceeds the specified range, the setting is ignored.
- To exit the voltage setting mode, press ESC or F.
- The equipment can enter the voltage setting mode only in the Home Position or the frequency setting mode.
- In the Initial Setup Status, the output voltage set value shows 0.0 V.

Caution

- *Output voltage can be set from 0.0 V. However, the actual output voltage does not go below 0.1 V to 0.6 V. (This value varies with the output voltage range and temperature.)*
- *Since the equipment's output impedance is very low, current may flow even when output voltage is set to 0.0 V, depending on the load. When you do not wish to allow current to flow or when connecting a load, always set OUTPUT OFF or turn OFF the POWER switch.*

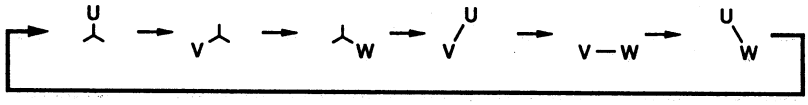
Setting three-phase voltage simultaneously

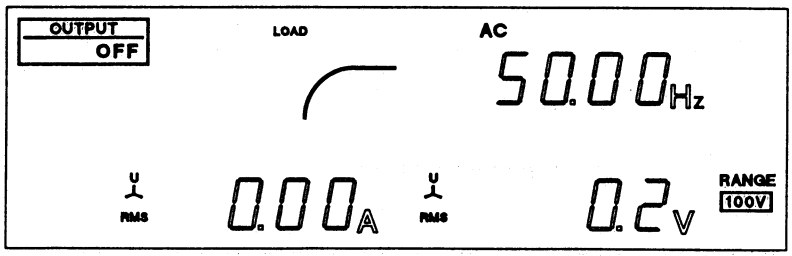
- Setting the voltage in three-phase voltage setting mode applies the same phase voltage to the U, V, and W phases.

- To enter the three-phase voltage setting mode, press SHIFT + 2 (PHASE) while in U-phase voltage setting mode.

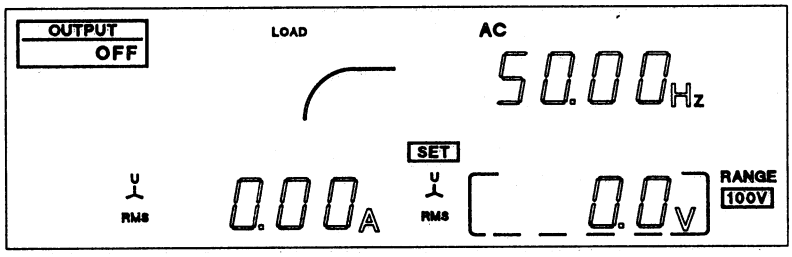
Step 1 Press ESC to select the Home Position.

Step 2 Press SHIFT + 2 (PHASE) to select the U-phase voltage display mode. Each time SHIFT + 2 (PHASE) is pressed, the voltage display mode changes as follows:



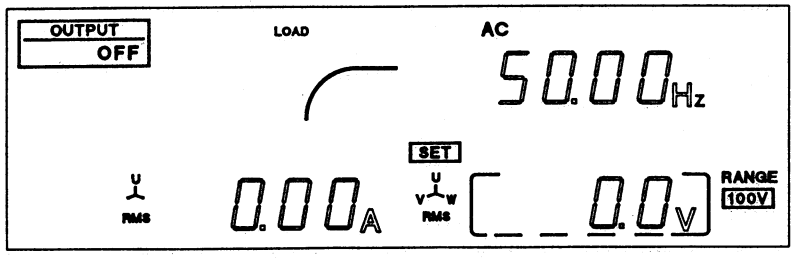


Step 3 Press "V" to enter the voltage setting mode.



- This causes the yellow frame that encircles the voltage display area to light, indicating that setting is possible.

Step 4 Press SHIFT + 2 (PHASE) to select the three-phase voltage setting mode.



Step 5 Set the output voltage.

- Using the numeric keys (0 to 9), enter a voltage value and press ENT to set it.

[Description] Entry using the numeric keys is possible when the output is OFF. When the output is ON, entry using the numeric keys is possible only when the "SET" is lit. In the voltage setting mode, voltage setting using JOG/SHUTTLE is always possible. For details, refer to Section 6.6, "How to Use JOG and SHUTTLE".

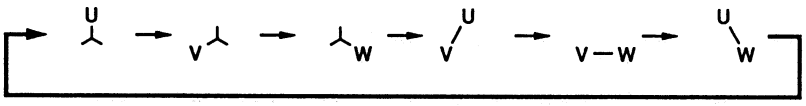
6.2.2 Line Voltage Setting

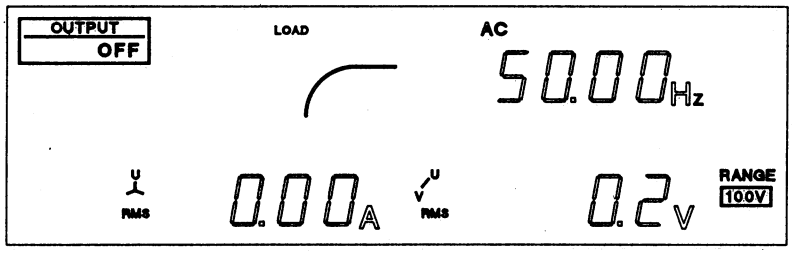
The equipment allows the line voltage to be set only when the U, V, and W phase voltages are identical.

- When setting the line voltage, the same value applies to the U-to-V, V-to-W, and W-to-U line voltages. Setting individual line voltages is not possible.
- Before setting the line voltage, set a common phase voltage for all phases. For instructions on setting the phase voltage, see 6.2.1, Setting Phase Voltage.

Step 1 Press ESC to select the Home Position.

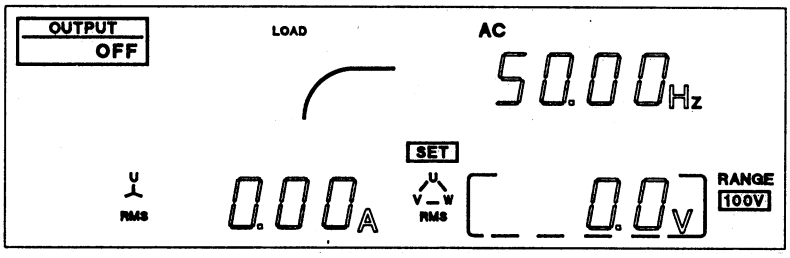
Step 2 Press SHIFT + 2 (PHASE) to select the line voltage display mode. Each time SHIFT + 2 (PHASE) is pressed, the voltage display mode changes as follows:





- When setting the line voltage, the same value is set for all connections; the phase indication at the left of the voltage display area may be for U-V, V-W, or W-U.

Step 3 Press "V" to enter the voltage setting mode.



- This causes the yellow frame that encircles the voltage display area to light, indicating that setting is possible.

Step 4 Set the output voltage.

- Using the numeric keys (0 to 9), enter a voltage value and press ENT to set it.

[Description] Entry using the numeric keys is possible when the output is OFF. When the output is ON, entry using the numeric keys is possible only when the "SET" is lit. In the voltage setting mode, voltage setting using JOG/SHUTTLE is always possible. For details, refer to Section 6.6, "How to Use JOG and SHUTTLE".

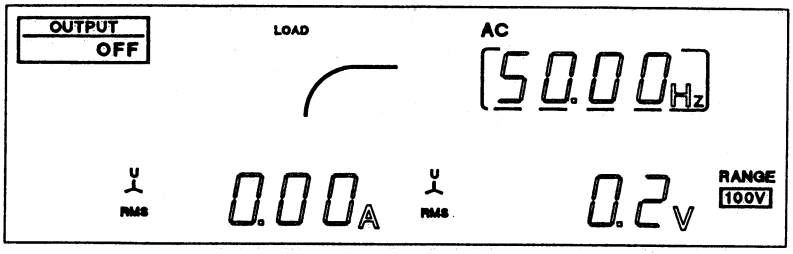
6.3 Frequency Setting

The equipment allows frequency setting. The equipment stores the frequency, and when the POWER switch is turned ON, it sets the frequency applied immediately before the POWER switch was turned OFF.

Procedure for Setting the Frequency

Step 1 Press ESC to select the Home Position.

Step 2 Press "F" to enter the frequency setting mode.



- This causes the yellow frame that encircles the frequency display area to light, indicating that setting is possible.

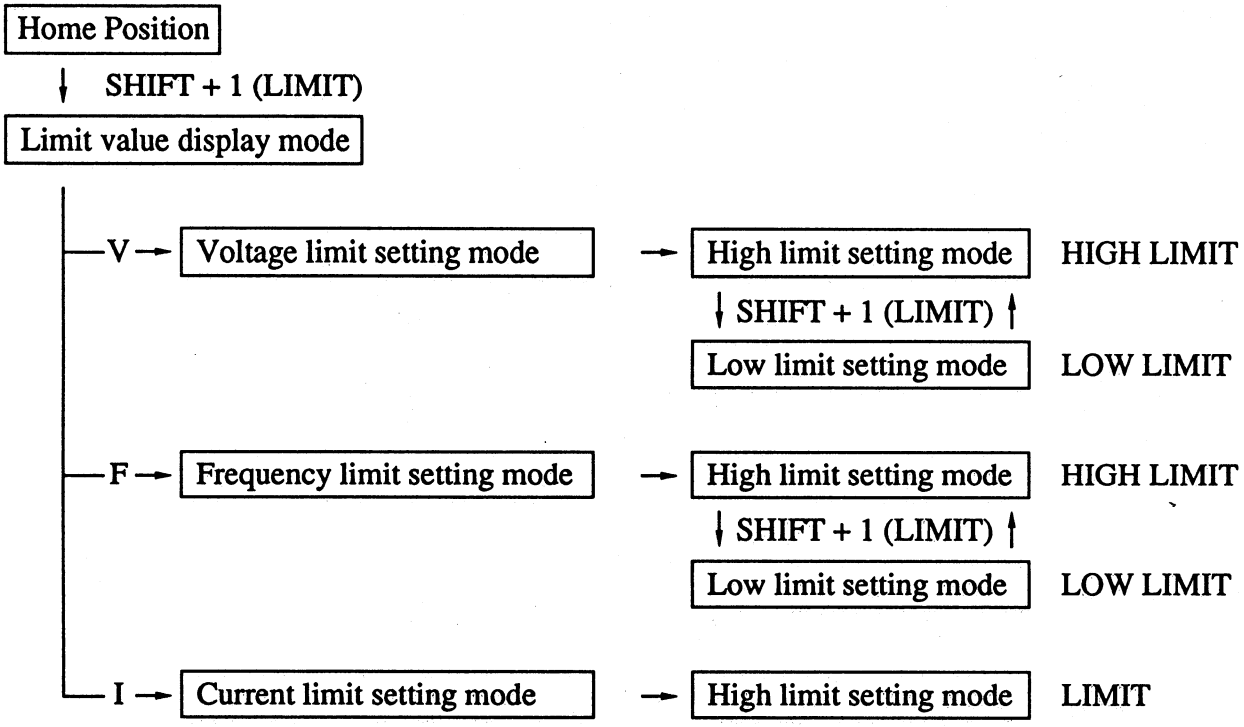
Step 3 Set the Frequency.

- Using the numeric keys (0 to 9), enter the frequency and press ENT to set it.
- Frequency setting is also possible using JOG and SHUTTLE. For details, see section 6.6, "How to Use JOG and SHUTTLE."
- If an attempt is made to set a frequency that exceeds the specified range, the setting is ignored.
- To exit the frequency setting mode, press ESC or V.
- The equipment can enter the frequency setting mode only in the Home Position or the voltage setting mode.
- In the Initial Setup Status, the frequency is at 50.00 Hz.

6.4 Limit Value Setting

The equipment allows the phase voltage and frequency setting ranges to be specified. Moreover, when the output current rms high limit is set, the equipment turns the output OFF if the actual output current value exceeds the high limit.
The high and low phase voltage and frequency limits and output current rms high limit are all called limit values. They are called voltage limit values, frequency limit values, and current limit value for the voltage, frequency, and output current rms, respectively.

Mode for limit value setting are as follows:



6.4.1 Setting the Voltage Limit Values

A high voltage limit value is called a high limit and a low voltage limit value a low limit. The equipment stores voltage limits values, and when the POWER switch is turned ON, it sets the voltage limit values applied immediately before the POWER switch was turned OFF.

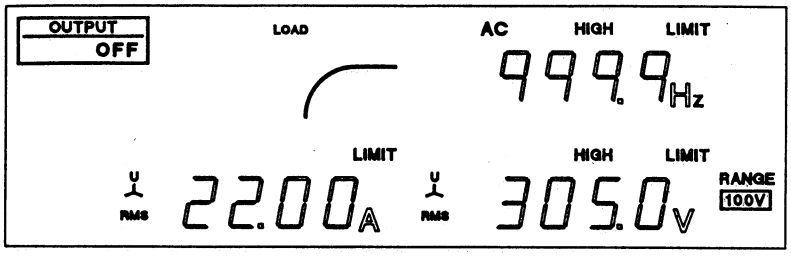
- In the Initial Setup Status, the voltage limit values are set to the values of the maximum variable range of the equipment.
- Any output voltage that exceeds the voltage limits cannot be set, except 0 V; 0 V can be set even if it is not within the voltage limit range.
- Setting limit values causes all the phase voltage settings to be limited to those limit values. Limit value cannot be set for individual phases.
- Output line voltage is limited to about 1.73 times the voltage limit value. Voltage limits cannot be set for the line voltage.

(Caution) *Output of an unreasonably high voltage due to an erroneous setting may damage the load connected to the equipment or expose the operator to danger. Therefore, always set the voltage limit values beforehand.*

Procedure for Setting the Voltage Limit Value

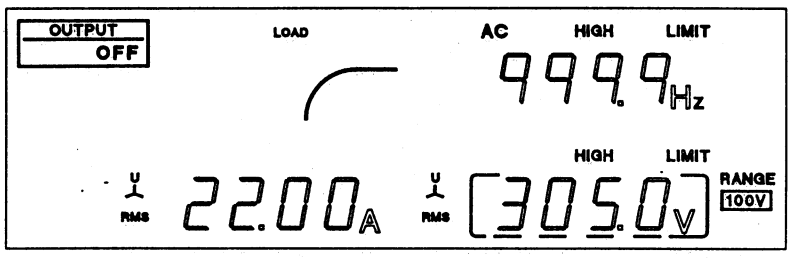
Step 1 Press ESC to select the Home Position.

Step 2 Press SHIFT + 1 (LIMIT) to select the limit value display mode.



- "HIGH" and "LIMIT" light, and the values of the voltage, frequency, and current high limit appear.

Step 3 Press "V" to select the voltage limit value setting mode. In this case, the high limit setting mode is activated.

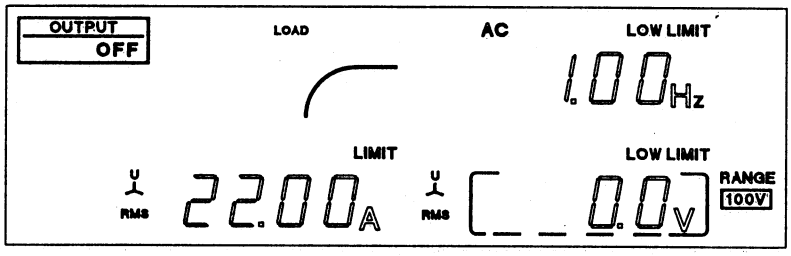


- The yellow frame that encircles the voltage display area lights to indicate that setting is possible.

Step 4 Set a high limit value.

- Use the numeric keys or JOG/SHUTTLE to set a high limit value. Setting is accomplished in the same way as voltage setting (See Section 6.3, step 3).

Step 5 Press SHIFT + 1 to select the low limit setting mode.



This causes "LOW LIMIT" to light.

Step 6 Set a low limit value.

Step 7 Press ESC to exit the voltage limit setting mode.

In the voltage limit setting mode, the following occurs.

- Pressing SHIFT + 1 (LIMIT) allows you to switch between the high and low limit setting modes.

High limit setting mode	HIGH LIMIT
↓ SHIFT + 1 (LIMIT) ↑	
Low limit setting mode	LOW LIMIT

- Pressing "F" transfers the status to the frequency limit setting mode and pressing "I" to the current limit setting mode. However, the low limit setting mode does not allow transfer to the current limit setting mode even when "I" is pressed.
- Pressing ESC returns the status to the limit value display mode and pressing ESC once again selects the Home Position.

6.4.2 Setting the Frequency Limit Values

A high frequency limit value is called a high limit and a low frequency limit value a low limit. The equipment stores the frequency limit values, and when the POWER switch is turned ON, it sets the frequency limit values applied immediately before the POWER switch was turned OFF.

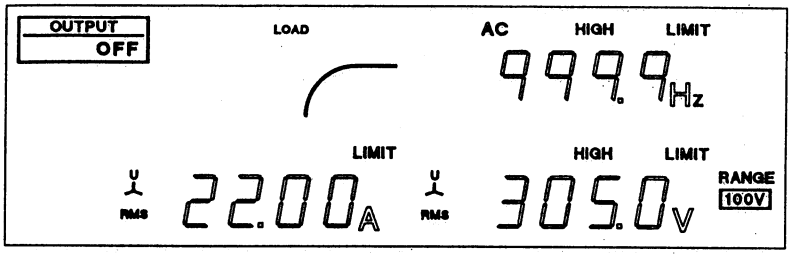
- In the Initial Setup Status, frequency limit values are set to the values of the maximum variable range of the equipment.
- Any frequency that exceeds the frequency limits cannot be set.

(Caution) *Outputting frequency that exceeds the specified range due to an erroneous setting may damage the load connected to the equipment or expose the operator to danger. Therefore, always set the frequency limit values beforehand.*

Procedure for Setting the Frequency Limit Value

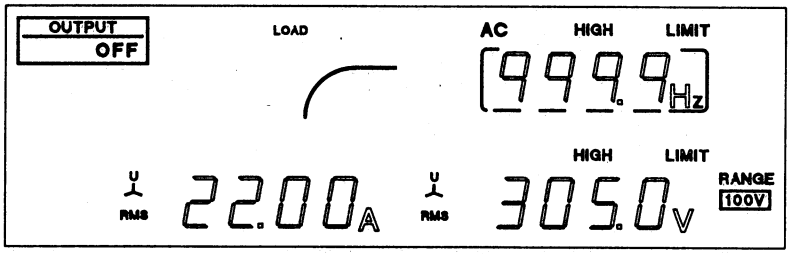
Step 1 Press ESC to select the Home Position.

Step 2 Press SHIFT + 1 (LIMIT) to select the limit value display mode.



- "HIGH" and "LIMIT" light, and the values of the voltage, frequency, and current high limit appear.

Step 3 Press "F" to select the frequency limit setting mode. In this case, the high limit setting mode is activated.

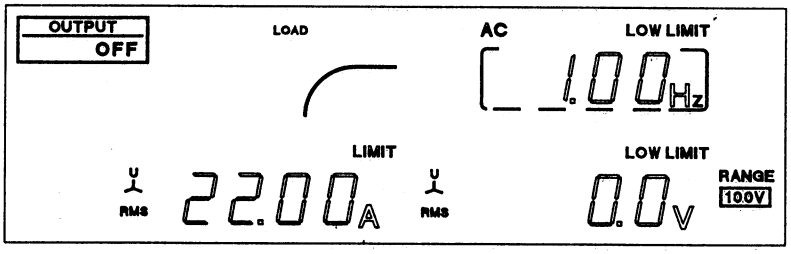


- The yellow frame that encircles the frequency display area lights to indicate that setting is possible.

Step 4 Set the high limit value.

- Use the numeric keys or JOG/SHUTTLE to set the high limit value. Setting is accomplished in the same way as frequency setting (See Section 6.3, step 3).

Step 5 Press SHIFT + 1 to select the low limit setting mode.



This causes "LOW LIMIT" to light.

Step 6 Set the low limit value.

Step 7 Press ESC to exit the frequency limit setting mode.

In the frequency limit setting mode, the following occurs.

- Pressing SHIFT + 1 (LIMIT) allows you to switch between the high and low limit setting modes.

High limit setting mode	HIGH LIMIT
↓ SHIFT + 1 (LIMIT) ↑	
Low limit setting mode	LOW LIMIT

- Pressing "V" transfers the status to the voltage limit setting mode and pressing "I" to the current limit setting mode. However, the low limit setting mode does not allow transfer to the current limit setting mode even when "I" is pressed.
- Pressing ESC returns the status to the limit value display mode and pressing ESC once again selects the Home Position.

6.4.3 Setting the Current Limit Value

The equipment stores the current limit values, and when the POWER switch is turned ON, it sets the current limit values applied immediately before the POWER switch was turned OFF.

- When the current limit value is set, the control panel LOAD level meter displays the full-scale value of the current limit. However, if the rated current value is lower than the current limit, it displays the full-scale value of the rated current.
- Setting limit values causes all output phase current to be limited to those limit values. Limit value cannot be set for individual phases.
- If a current that exceeds the current limit value flows, the control panel warning "OVERLOAD" lights and the output voltage drops. If this condition continues for about 10 sec, the output is automatically turned OFF.
- The function that controls the current limit works in current rms. Therefore, it does not directly respond to the peak current drawn by a capacitor-input rectifying load.
- In the Initial Setup Status, the current limit value is set to a value 1.1 times greater than the maximum rated current of the 100 V range.

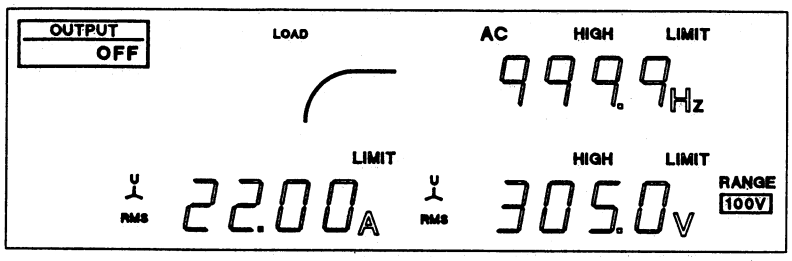
Caution *If this equipment's output current becomes greater than that for normal use due to an error in the load connected to the output of the equipment, the load may be damaged. (If the wire that connects the equipment to the load is not sufficiently thick, the wire may burn.) To prevent such a problem, use wires with sufficient current capacity and also set the current limit values. To select the proper wire, see the table of the wire size and the allowable current in Chapter 3.2, Step 3.*

Procedure for Setting the Current Limit Value

The current limit value requires only the high limit value setting.

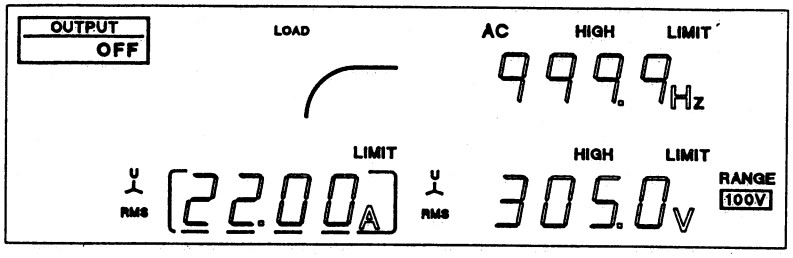
Step 1 Press ESC to select the home position.

Step 2 Press SHIFT + 1 (LIMIT) to select the limit value display mode.



- "HIGH" and "LIMIT" light, and the values of the voltage, frequency, and current high limit appear.

Step 3 Press "I" to select the current limit value setting mode.



- The yellow frame that encircles the current display area lights to indicate that setting is possible.

Step 4 Set the limit value.

- Use the numeric keys or JOG/SHUTTLE to set the high limit value. Setting is accomplished in the same way as frequency setting (See Section 6.3, Step 3).

Step 5 Press ESC to exit the current limit setting mode.

In the current limit setting mode, the following occurs:

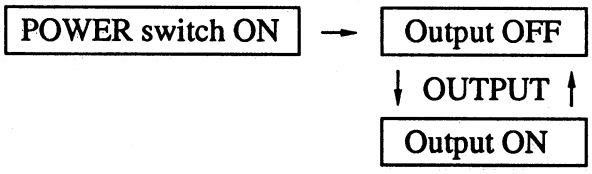
- Pressing "F" always transfers the status to the frequency limit setting mode and pressing "V" to the voltage limit setting mode.
- Pressing ESC returns the status to the limit value display mode and pressing ESC once again selects the Home Position.

6.5 Output ON/OFF

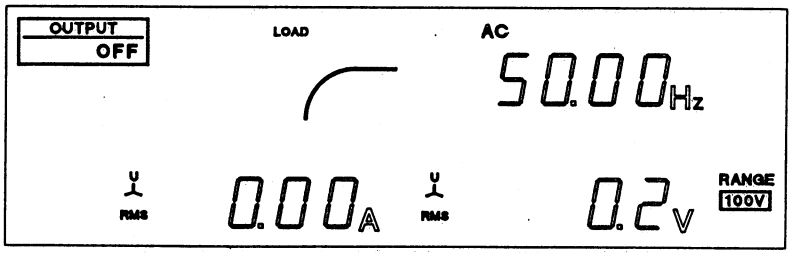
Using OUTPUT, switching between the output ON condition (in which power is fed to the load) and the output OFF condition (in which no power is fed to the load) is possible.
Output ON/OFF is displayed as follows on the control panel.

Output ON status: OUTPUT ON lights.
Output OFF status: OUTPUT OFF lights.

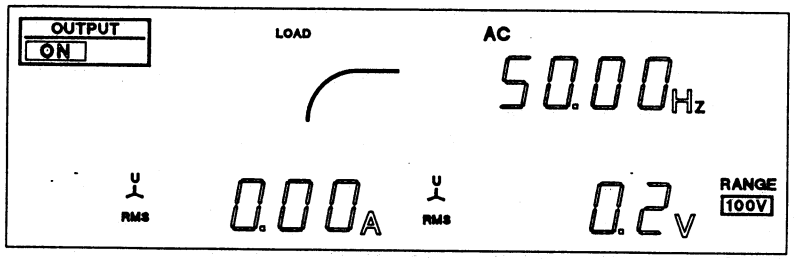
Immediately after the POWER switch has been turned ON, output is set to OFF (OUTPUT OFF). Whenever OUTPUT is pressed, output ON/OFF changes alternately.



Output OFF



Output ON



Description Output ON/OFF Switching

This equipment does not cut off output from the internal circuits mechanically using switches and relays, but rather increases output impedance electrically to turn the output off. This allows output to be turned ON/OFF in a smooth waveform without producing any contact chatter. When output is OFF, the output is in the high impedance condition.

* In the high impedance condition, the impedance (resistance) value is approximately as follows:

- For the 100 V output range
  R_{OFF} = About 8 + N [kΩ]
- For the 200 V output range
  R_{OFF} = About 32 + N [kΩ]

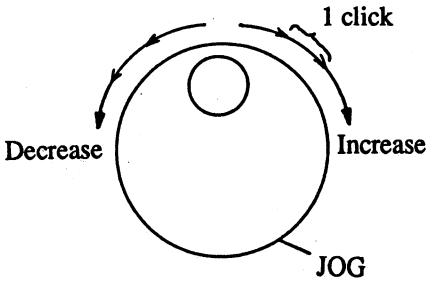
N indicates the value equivalent to the PCR-LT series rated output capacity /3 [kVA].
Example: Impedance in PCR6000LT's 200 V output range
R_{OFF} = About 32 + 2 [kΩ] = about 16 [kΩ]

6.6 How to Use JOG and SHUTTLE

6.6.1 Numeric Setting Using JOG/SHUTTLE

Numeric setting using JOG

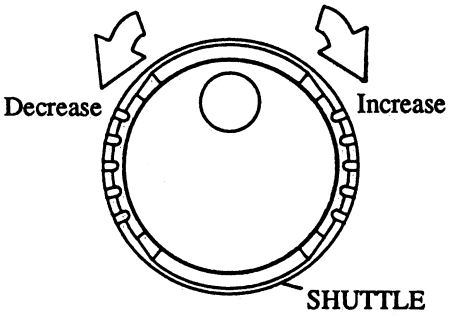
Turn JOG clockwise to increase the displayed value or counterclockwise to decrease it. The displayed value is established as a set value whenever changed. (Pressing ENT is not required.)



- JOG is useful in making fine set-value adjustments.
- Any value that exceeds the allowable range is ignored.

Numeric setting using SHUTTLE

Turn SHUTTLE clockwise and hold it to increase the displayed value continuously or turn it couterclockwise and hold it to decrease the value continuously. Return SHUTTLE to the neutral position to stop the set value change. The displayed value is established as a set value whenever changed.
(Pressing ENT is not required.)



- Turning SHUTTLE to a greater degree of angle increases the speed at which the numeric change is made.
- The numeric change speed can be changed in four steps.
- SHUTTLE is useful for changing the set value to an approximate desired value.
- Any value that exceeds the allowable range is ignored.

(Caution)

- *When SHUTTLE is used, the set value may be increased or decreased too much because of the rapid speed at which the set value changes.*
- *Output voltage or frequency that exceeds the specified range may damage the load connected to the equipment or expose the operator to danger. Therefore, always set the voltage and frequency limit values beforehand. For details, see section 6.4, "Limit Value Setting."*

6.6.2 How to Use the Digit Function

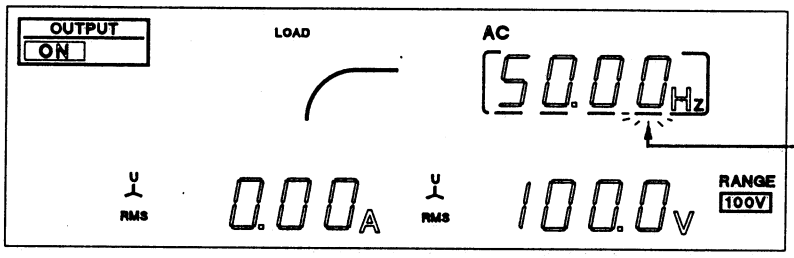
The digit function allows you to change the higher digits than the specified one using JOG or SHUTTLE when the voltage or frequency is set. This function is useful for making step changes in the voltage or frequency setting.

Procedure for Using the Digit Function

Take the following steps in the voltage or frequency setting mode. (The setting mode is the status in which the yellow frame encircling the voltage or frequency display area is lit, which is obtained by pressing V or F.)

Step 1 Press SHIFT + . (DIGIT).

This causes the cursor (part of the yellow frame) to blink at the specified variable digit, and to select the digit mode. This mode allows the digit where the cursor blinks and a higher digit to be changed.



- The digit where the cursor blinks is called the specified digit.
- Pressing SHIFT + . (DIGIT) once makes the specified digit move one digit to the left.

Step 2 Press SHIFT + . (DIGIT) the required number of times to move the cursor to the desired digit.

- Pressing SHIFT + . (DIGIT) when the cursor is at the most significant digit causes the cursor to return to the least significant digit.
- The value at the specified digit can also be set using the numeric keys and ENT key, but the digit function is cancelled after the specified digit is set.
- To exit the digit function, press ESC, ENT, or CLR.
- For voltage, the digit function can be used only when SET is lit.

6.7 Setting the Voltage Display Mode

6.7.1 Switching the Voltage Display Mode

The equipment has phase voltage and line voltage display modes. Each of these modes has specific voltage display modes.

Voltage display mode	Indication at the left of the voltage display area (lit)
U-phase voltage display mode	
V-phase voltage display mode	
W-phase voltage display mode	
U-to-V line voltage display mode	
V-to W line voltage display mode	
W-to-U line voltage display mode	

Voltage display mode		Control panel indication (lit)
rms value display mode	(RMS)	V RMS
Peak value display mode	(PEAK)	V PEAK
Set voltage display mode	(SET)	V SET RMS*

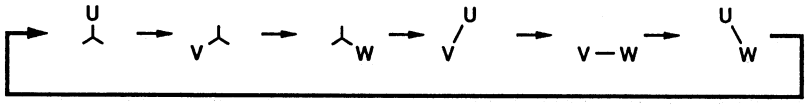
* In phase voltage display mode, this voltage mode is available only when all phase voltages are identical and output is ON.
In the line voltage display mode, the mode is available only when all phase voltages are identical.

- In the Initial Setup Status, the rms value display mode (RMS) of U-phase voltage is activated.
- The equipment stores the voltage display mode, and when POWER switch is turned ON, it sets the voltage display mode applied immediately before the POWER switch was turned OFF.

Procedure for Switching the Voltage display Mode

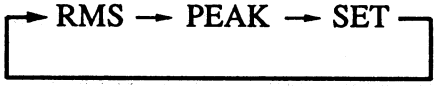
Switching the phase in which output voltage is displayed

Step 1 Press SHIFT + 2 (PHASE).
Each time SHIFT + 2 (PHASE) is pressed, the voltage display mode changes as follows:



Switching the output voltage measurement mode

Step 2 Press SHIFT + V (V MODE).
Each time SHIFT + V (V MODE) is pressed, the voltage display mode changes as follows:



Description Voltage Display Mode

The voltage display mode can be classified into a set-voltage display and a measured voltage display as follows:

Set-voltage display:	Displays the currently set voltage value.
Measured voltage display:	Displays the actual output voltage value in two measuring methods.

Displayed output voltage value is calculated from 256 points of data obtained by sampling of output voltage. There are following three sampling methods for set-frequency.

1. Set-frequency is between ≥1 Hz and <16 Hz.
256 points are sampled in one period of waveform as actual time. Because data for calculation are obtained in one period of waveform, measurement cycle is one period.

2. Set-frequency is between ≥16 Hz and <256 Hz.
16 points are sampled in one period of waveform. This sampling is repeated 16 times, and 256 points of data are obtained. Because 16 periods of waveform is required to obtain data for calculation, measurement cycle is 16 periods.

3. Set-frequency is between ≥256 Hz and <1 kHz
One point is sampled in one period of waveform. This sampling is repeated 256 times, and 256 points of data are obtained. Because 256 periods of waveform is required to obtain data for calculation, measurement cycle is 256 periods.

The output voltage measuring method includes rms value measurement, and peak value measurement. One of these measuring methods should be set for voltage measurement. The features of these measuring methods are as follows:

Rms value measurement (RMS)

Rms value is calculated from 256 points of data obtained by sampling of waveform.

Peak value measurement (PEAK)

Maximum absolute value is calculated from 256 points of data obtained by sampling of waveform.

- The peak voltage display provides an absolute value with no polarity sign.
- The peak value is reset after every measurement cycle.
- Because it is measurement by sampling waveform, the peak that occurred between sampling points cannot be measured.

6.8 Setting the Current/Power Display Mode

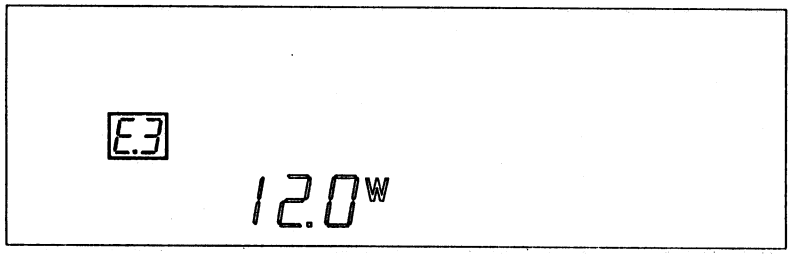
6.8.1 Switching the Current/Power Display Mode

The current/power display modes, against all phase current, are provided in the table below.

Current/power display mode	Indication at the left of the voltage display area (lit)
U-phase current display mode	U
V-phase current display mode	V
W-phase current display mode	W

Current/power display mode	Control panel indication (lit)
Current rms value display mode (RMS)	A RMS
Peak current value display mode (PEAK)	A PEAK
Power display mode (W)	W (E3)*1

*1 If output power exceeds 10 kW on the PCR12000LT AC Power Supply, the control panel displays "E3."
Example) Display of the control panel for an output power of 12000 W

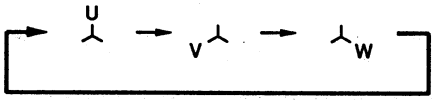


- In the Initial Setup Status, the rms value display mode (RMS) is activated.
- The equipment stores the current/power display mode, and when the POWER switch is turned ON, it sets the current/power display mode applied immediately before the POWER switch was turned OFF.
- Measurement of output voltage is not available in the line voltage display mode.

Procedure for Switching the Current/Power Display Mode

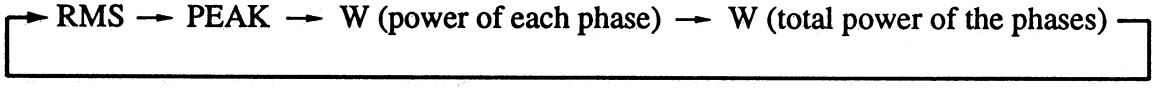
Switching the output current display phase

Step 1 Press SHIFT + 2 (PHASE)
Each time SHIFT + 2 (PHASE) is pressed, the current display mode changes as follows:



Switching the output current measurement

Step 2 Press SHIFT + I (I MODE)
Each time SHIFT + I (I MODE) is pressed, the current/power display mode changes as follows:



Description Current/Power Display Mode

Displayed output current value is calculated from 256 points of data obtained by sampling of output current. There are following three sampling methods for set-frequency.

1. Set-frequency is between ≥1 Hz and <16 Hz.
256 points are sampled in one period of waveform as actual time. Because data for calculation are obtained in one period of waveform, measurement cycle is one period.

2. Set-frequency is between ≥16 Hz and <256 Hz.
16 points are sampled in one period of waveform. This sampling is repeated 16 times, and 256 points of data are obtained. Because 16 periods of waveform is required to obtain data for calculation, measurement cycle is 16 periods.

3. Set-frequency is between ≥256 Hz and <1 kHz
One point is sampled in one period of waveform. This sampling is repeated 256 times, and 256 points of data are obtained. Because 256 periods of waveform is required to obtain data for calculation, measurement cycle is 256 periods.

The methods by which the output current can be measured include rms value measurement, peak value measurement, and power measurement. One of these methods should be set for current/ power measurement. The features of these measuring methods are as follows:

Current rms value measurement (RMS)

Rms value is calculated from 256 points of data obtained by sampling of waveform.

Peak current measurement (PEAK)

Peak current value is measured by catching the peak value of current with a peak holding circuit.
- The peak current display indicates an absolute value with no polarity sign.
- The peak value is reset after every measurement cycle.

Power measurement (W)

Power value is calculated from 256 points of data obtained by sampling of voltage and current waveforms.
- Since power is calculated based on phase voltage and phase current data, the equipment displays phase power or a total of three phase-power.

6.8.2 How to Use the LOAD Level Meter

The equipment LOAD level meter detects the current flowing in a load and displays (for reference) the ratio of the load current value to the rated current value.

[Description]

- The current flowing in a load varies depending on the load connected. Output current is derated depending on output voltage, frequency, or load factor and rated current changes with load status. Therefore, obtaining an accurate ratio of the load current value to the rated current value is difficult. The LOAD level meter applies a momentary rated current value or current limit value, whichever is smaller, as a full scale and displays the ratio of a load current value to the relevant value. The level meter should be used as a reference to know the available load current.
- The LOAD level meter shows the load status of the phase where the rate of load current to rated current/current limit values. It does not necessarily agree with the output phase that is displayed in the current display area.

Examples of LOAD level meter displays

Below are some display examples of the PCR6000LT LOAD level meter.

- To display derating in the rated output current according to the output voltage setting
  Example: For 100 V output phase voltage (in the 100 V range)
  The rated current 20A is displayed as a full scale.
  For 150 V output phase voltage (in the 100 V range)
  The rated current 13.3 A is displayed as a full scale.

- To display the change in the rated output current caused by the output voltage range
  Example: For the 100 V range
  The rated current 20A is displayed as a full scale.
  For the 200 V range
  The rated current 10 A is displayed as a full scale

- To display derating in the rated output current caused by output frequency
  Example: For 50 Hz
  The rated current 20A is displayed as a full scale.
  For 5 Hz
  The rated current 10 A is displayed as a full scale.

- To display a current limit set value as the rated output current
  Example: For current limit 5 A
  The rated current 5 A is displayed as a full scale.

- To display the value when the equipment's inner IC protective circuit is operating, as rating.
  Example: For loads whose power factor is 0.4
  A rated current of about 10 A is displayed as a full scale.

6.9 Memory Function

The function allows the phase voltage and frequency set values to be stored in the memory beforehand for subsequent reading out and setting. This feature is convenient for writing frequently used voltage and frequency set-values in the memory.

The memory of line voltage is not provided.

Description Memory Function

The memory function allows the output voltage and output frequency set-values to be written as a set in the memory for later reading out and setting. The memory allows nine sets of data to be stored. The memory addresses are 1 to 9.
The memory function is available only in the phase voltage display mode. Also, data can be saved to the memory only when the phase voltage settings are all identical.

The following table shows the data set in the memory in the Initial Setup Status.

Memory address	Phase voltage	Frequency
0	0.0 V	50 Hz
1	0.0 V	50 Hz
2	0.0 V	50 Hz
3	0.0 V	50 Hz
4	0.0 V	60 Hz
5	0.0 V	60 Hz
6	0.0 V	60 Hz
7	0.0 V	400 Hz
8	0.0 V	400 Hz
9	0.0 V	400 Hz

- Since the equipment stores the data in its memory, the stored values can be retrieved as desired.
- Memory address 0 is for read-out only.

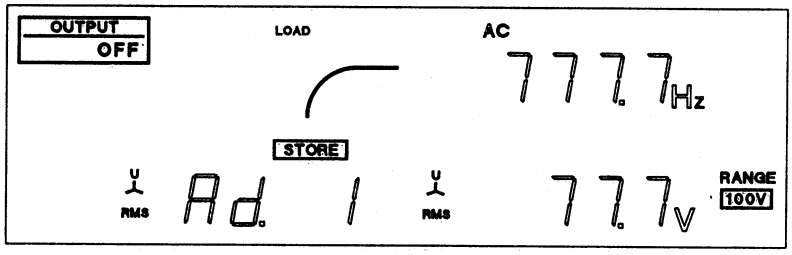
Procedure for Storing Data in the Memory

Step 1 Set the phase voltage (and frequency) you wish to store. All phase voltages must be identical.

Step 2 Press ESC to select the Home Position.

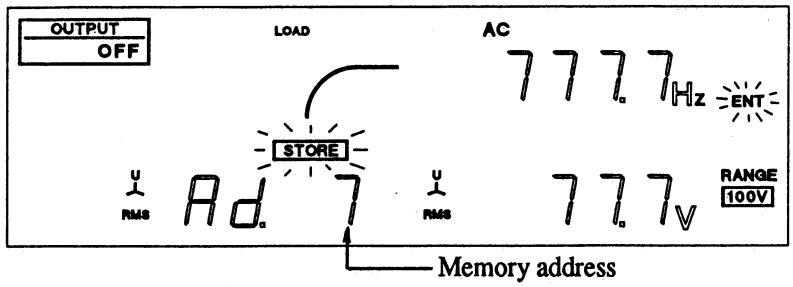
Step 3 Press SHIFT + 2 (PHASE) to select the phase voltage display mode.

Step 4 Press SHIFT + MEM (STORE).



Step 5 Press any of the keys from 1 to 9 to select the write destination memory address.

This will cause "Ad. X" (X: number) to appear in the current display area and "STORE" to blink.



Step 6 To establish the memory address, press ENT.

- To cancel the selection, press ESC.

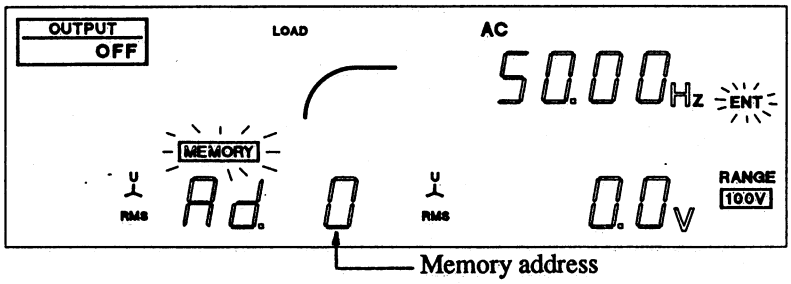
Step 7 The voltage (and frequency) are written (as a pair) in the memory.

Memory Read Procedure

Step 1 Press ESC to select the Home Position.

Step 2 Press SHIFT + 2 (PHASE) to select the phase voltage display mode.

Step 3 Press MEM.



Step 4 Press any of the keys from 1 to 9 to select the read destination memory address. This will cause "Ad. X" (X: number) to appear in the current display area. The voltage and frequency stored in the relevant memory address are retrieved and displayed in the respective voltage and frequency display areas.

Step 5 To establish the retrieved value(s) as the set value(s), press ENT.

- To cancel the value(s), press ESC.

[Description] Use of the Remote Controller (RC02-PCR-L), GP-IB Interface (IB11-PCR-L), or RS-232C Interface (RS11-PCR-L) allows a maximum of 99 sets of memory-stored data to be set. In this case, memory addresses 1 to 9 can be accessed from both the control panel and the optional equipment. See Chapter 7 OPTIONAL EQUIPMENT or, for details, see the operation manual of each unit.

6.10 Synchronous Function

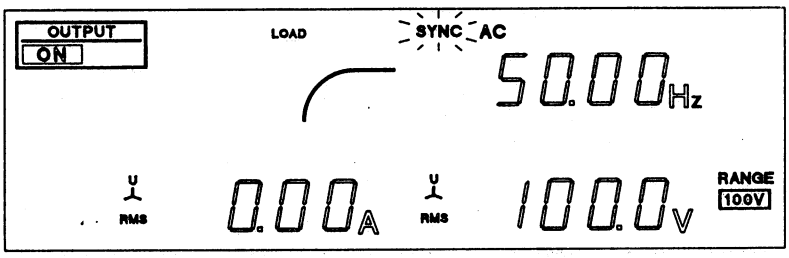
The synchronous function synchronizes the equipment's output voltage frequency and phase to that of 50 or 60 Hz of the input power source.

Procedure for Setting the Synchronous Mode

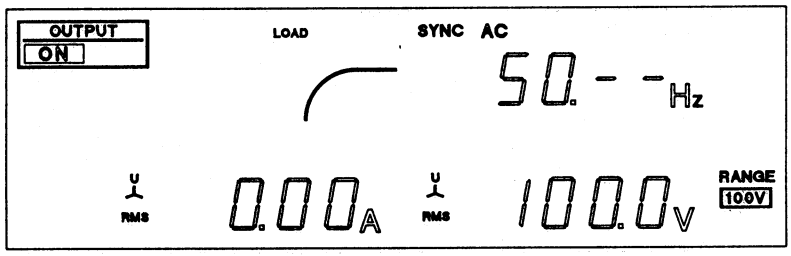
Step 1 Press ESC to select the Home Position.

Step 2 Press SHIFT + 9 (SYNC).

This activates the synchronous mode, causing SYNC to blink.

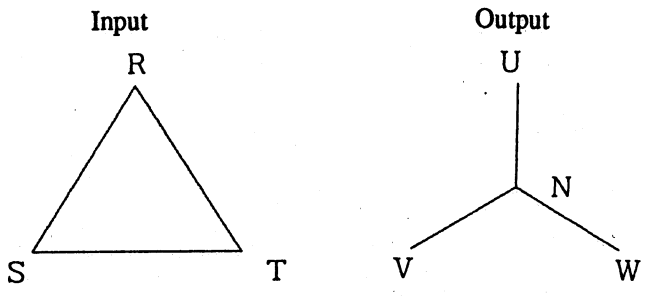


The equipment attempts to synchronize the output voltage frequency and phase with the frequency of the input power source.
Several seconds later SYNC lights, indicating that the frequency and phase have synchronized with the frequency of the input power source.
The synchronized frequency (50 or 60 Hz) is displayed on the frequency display area. (50. -- or 60. --)



- In the synchronous mode the frequency limiting function does not operate.
- To cancel the synchronous mode, press SHIFT + 9 (SYNC).
- The synchronous mode is also cancelled when the POWER switch is turned OFF.
- When the synchronous mode is cancelled, the frequency is fixed to 50 or 60 Hz, whichever has been set. If the frequency limiting function operates in this condition, the frequency is set to the high or low limit values, whichever is closer.

[Description] Because the input of the equipment uses a three-phase three-wire system and the output uses a three-phase four-wire system, the phases are synchronized as shown in the figure below.



Phase U: Synchronizes with R-to-S line phase.

Phase V: Causes a 120 degree phase lag from phase U.

Phase W: Causes a 240 degree phase lag from phase U.

6.11 Key-Lock Function

The key lock function prevents key operation through the control panel.

This function is used to prevent the set values from being changed by accident in order to retain the desired output voltage and frequency.

- The key-lock function is not applied in the initial setup status.

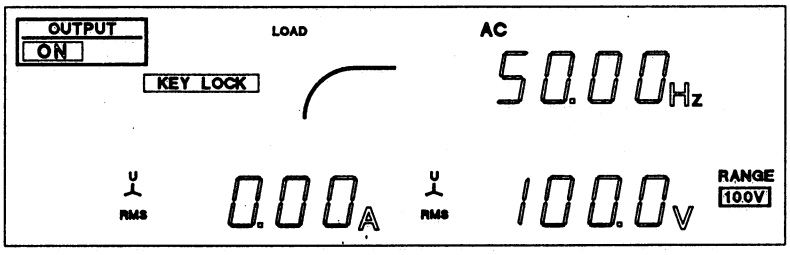
[Description] Operation via the control panel can also be locked using the key-lock function when the Remote Controller (RC02-PCR-L) is used. See Chapter 7 OPTIONAL EQUIPMENT or, for details, see the operation manual of each optional equipment.

Key-Lock Procedure

Step 1 Press ESC to select the Home Position.

Step 2 Press SHIFT + 4 (KEYLOCK).

This activates the key-lock mode, causing KEYLOCK to light.



- OUTPUT is available even in the key-lock mode.

- The key-lock mode is retained until cancelled. If the key-lock mode was on when the POWER switch was turned OFF, the key-lock mode is also activated when the POWER switch is turned ON again.
- To cancel the key-lock mode, press SHIFT + 4 (KEYLOCK) again.

Chapter 7
OPTIONAL EQUIPMENT

Describes options available for this equipment.

Contents

7.1 Introducing Optional Products

The following optional products are available for the PCR-LT series AC power supplies. An option is inserted into a slot in the equipment for use.

Product	Model	Applicable slot number
Remote Controller	RC02-PCR-L	1, 2, 3
GP-IB Interface	IB11-PCR-L	1, 3
RS-232C Interface	RS11-PCR-L	1, 2, 3

[Description]

- IB11-PCR-L requires a computer with a GPIB interface and a GPIB cable.
- RS11-PCR-L requires a computer with an RS-232C interface and a RS-232C cable (reverse cable).
- The applicable slot numbers in the table show which slots are available from among slots 1 to 5 in the equipment. When more than one applicable slot are available the relevant optional board can be inserted into any of the slots to accomplish the operation.

(Caution) *When using an optional device, see the operation manual of that product.*

Combined use of optional products

	RC02-PCR-L	IB11-PCR-L	RS11-PCR-L
RC02-PCR-L	*	Δ	Δ
IB11-PCR-L	Δ	*	×
RS11-PCR-L	Δ	×	*

Δ: Allows simultaneous installations in the equipment (however, optional products cannot be operated simultaneously.)
×: Allows no simultaneous installation in the equipment.
*: The same option cannot be used simultaneously.

(Caution) *Never attempt to use a combination of equipment designated by marks * and ×. Otherwise, the products will not operate normally. Using equipment marked * and equipment marked × together will cause damage both to the optional equipment and to the main equipment.*

7.2 Functions Available through Optional Equipment

7.2.1 Power Line Abnormality Simulation

The equipment allows simulation of power failure, fast voltage drop (dips), or fast voltage rise (pops). This function is used to test switching power supplies or micro-processor-based devices.

This function requires one of the following optional devices.
- RC02-PCR-L
- IB11-PCR-L
- RS11-PCR-L

7.2.2 Sequence Operation

Specifying sequence operation by combining output voltage and frequency or other factors with time setting allows automatic operation. This function can be used to automatically test a variety of devices and equipment.

This function requires one of the following optional devices.
- RC02-PCR-L
- IB11-PCR-L
- RC11-PCR-L

7.2.3 Harmonic Current Analysis Function

Harmonic current analysis is available for output current from the equipment. The conventional approach used an FFT analyzer for measurement. In contrast, this equipment requires no FFT analyzer. This function can be used for harmonic current analysis of various equipment.

This function requires one of the following optional devices.
- RC02-PCR-L
- IB11-PCR-L
- RS11-PCR-L

7.2.4 Special Waveform Output

This function allows the equipment to output any waveform other than sine waves. The "peak clipped waveform" in which the peak of a sine wave is suppressed is provided as standard. Also, if arbitrary waveform data is transferred to the equipment, the waveform can be output.
This function can be used not only for a variety of electronics devices but also for chemical experiments and production equipment.

This function requires one of the following optional devices.

Peak clipped waveform
- RC02-PCR-L
- IB11-PCR-L
- RS11-PCR-L

Arbitrary waveform
- IB11-PCR-L
- RS11-PCR-L

7.2.5 Output Impedance Setting

The equipment has almost 0 Ω output impedance (output resistance); the actual commercial power line has several mΩ to several Ω impedance (resistance). When an optional devise is connected, the equipment allows output impedance to vary. This allows simulation of the environment similar to actual commercial powerline.
This function is backed up inside the equipment. Therefore, once a setting is made using an optional device, the equipment can operate in the same condition continuously even if the option is removed, as long as the setting conditions remain the same. The function can be used to test various devices and equipment.

This function requires one of the following optional devices.
- RC02-PCR-L
- IB11-PCR-L
- RS11-PCR-L

7.2.6 Measurements of Power-Factor, VA, and Peak Holding Current

The equipment has diverse measuring functions which can be extended using an optional product. These additional functions include the measurement of power-factor, VA, and the peak holding current.
With peak holding current measurement, the peak current is measured until the equipment receives a peak clear signal or command. This function is useful in measuring a rush current and can be used to test various devices and equipment.

The function requires one of the following optional devices.
- RC02-PCR-L
- IB11-PCR-L
- RS11-PCR-L

7.2.7 Output ON/OFF Phase Setting

Output ON/OFF phase setting is available separately. This function is used when output ON/OFF phase setting is required. This function is backed up inside the equipment. Therefore, once setting is accomplished using an optional device, the equipment can operate in the same condition continuously with the option removed, as long as the setting conditions remain the same.

This function requires one of the following optional devices.
- RC02-PCR-L
- IB11-PCR-L
- RS11-PCR-L

7.2.8 Expansion of the Memory Function

This equipment allows nine sets of voltage and frequency settings to be stored as standards in the memory (memory addresses 1 to 9), enabling the data to be read for output as necessary. When an optional product is attached, the equipment can accommodate a maximum of 99 sets of voltage and frequency set values for storage.

This function requires one of the following optional devices.
- RC02-PCR-L
- IB11-PCR-L
- RS11-PCR-L

7.3 Use of the Remote Controller (RC02-PCR-L)

This section describes the functions available and the procedures required for using the PCR-LT Series AC Power Supply in combination with the remote controller (RC02-PCR-L).
The following section describes those functions and procedures which are different from those used in the single-phase operation of the PCR-L series power supply and remote controller.
For contents not described in this section, see the RC02-PCR-L Operation Manual. Be sure to read the RC02-PCR-L Operation Manual before reading this section.

7.3.1 Limited Functions

- DC and AC + DC modes
- Regulation adjustment

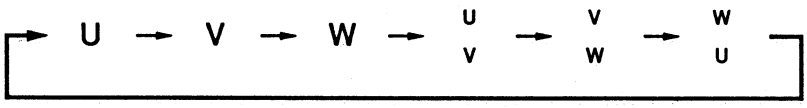
7.3.2 Switching between Phase Voltage Display and Line Voltage Display

The PCR-LT Series Power Supplies have phase voltage and line voltage display modes.

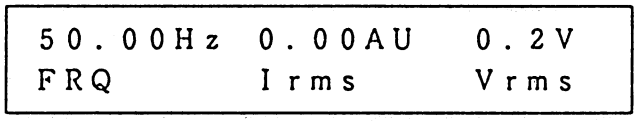
Selecting the Voltage Display

Step 1 Press ESC to call the home position.

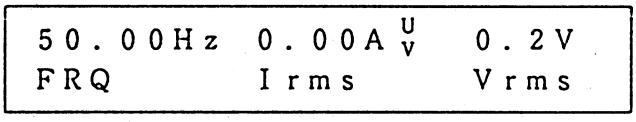
Step 2 Press SHIFT + 2 (PHASE) to select either phase voltage display mode or line voltage display mode for the output phase you wish to display.
Each time SHIFT + 2 (PHASE) is pressed, the voltage display mode changes as follows:



- Phase voltage display mode
  When the letter U, V, or W is displayed at the left of the LCD voltage display, the phase voltage display mode is selected.



- Line voltage display mode
  When the symbol $\frac{U}{V}$, $\frac{V}{W}$, or $\frac{W}{U}$ is displayed at the left of the LCD voltage display, the line voltage display mode is selected.



- In line voltage display mode, the condition of the current display area is as follows.

Voltage display mode	Display	Current display
U-to-V line voltage	$\frac{U}{V}$	U-phase current
V-to-W line voltage	$\frac{V}{W}$	V-phase current
W-to-U line voltage	$\frac{W}{U}$	W-phase current

7.3.3 Output Voltage Setting

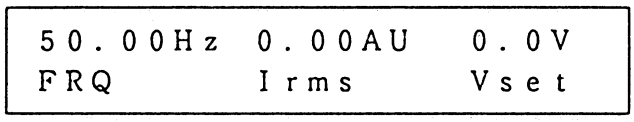
The PCR-LT Series Power Supplies have phase voltage and line voltage setting modes.

Step 1 Press ESC to call the home position.

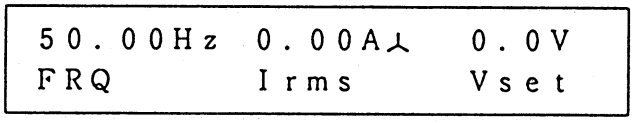
Step 2 Press SHIFT + 2 (PHASE) to select either phase voltage display mode or line voltage display mode for the output phase you wish to display.

Step 3 Press F5 to select the voltage setting mode (Vset).

- Phase voltage setting mode
  Sets the phase voltage of the letter displayed at the left of the LCD voltage display.



- Three-phase voltage setting mode
  Select the U-phase voltage setting mode and press SHIFT + 2 (PHASE). This selects the three-phase voltage setting mode.
  The ⅄ symbol appears at the left of the LCD voltage display.



- Line voltage setting mode
  △ symbol appears at the left of the LCD voltage display when the line voltage setting mode has been selected.

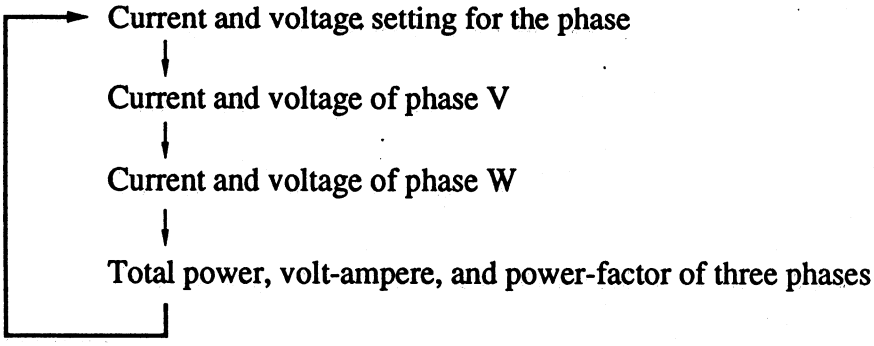
50.00Hz	0.00A△	0.0V
FRQ	Irms	Vset

- While in line voltage setting mode, the U-to-V phase difference must be 120 degrees and U-to-W phase difference must be 240 degrees for seelection to be made. Also, the voltage setting for each phase must be identical.
- In line voltage setting mode, the U-to-V phase difference and U-to-W phase difference cannot be changed.
- Measurement of output voltage is not available in line voltage display mode.

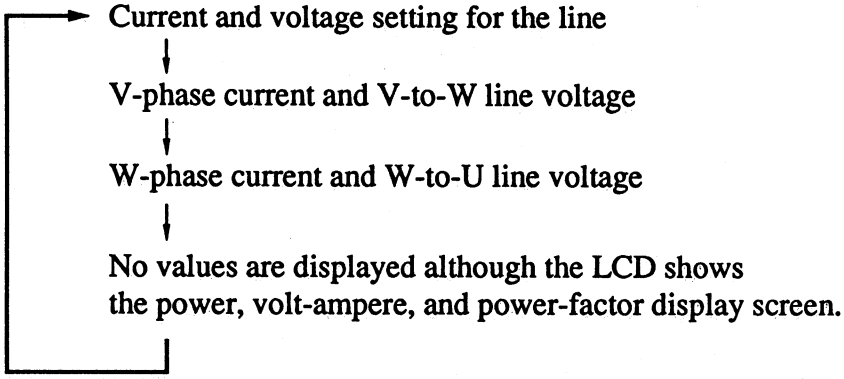
7.3.4 Display of V-/W-Phase Current, V-/W-Phase Voltage, or V-to-W/ W-to-U Line Voltage

Press ESC to call the home position.
Whenever MENU is pressed, the display changes as follows:

- In phase voltage display mode

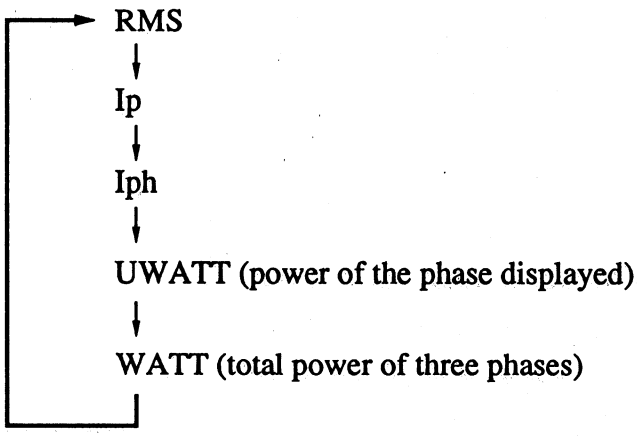


- In line voltage display mode



7.3.5 Selecting the Current/Power Display Mode

- Whenever SHIFT + F3 is pressed from the home position, the current/power display mode changes as follows:



- The phase power/total three-phase power display mode is selected from line voltage display mode, but no values are displayed on the LCD.

7.3.6 Setting U-to-V or U-to-W Phase Difference

Step 1 Press ESC to call the home position.

Step 2 Press MODE. This causes the following display to appear.

```
FREE          0Ω
PHASE        IMP
```

F1 F2 F3 F4 F5

Step 3 Press F1 (PHASE) to select the phase setting mode. This causes the following display to appear.

```
PHASE       FREE        FREE
          OUT_ON     OUT_OFF
```

F1 F2 F3 F4 F5

Step 4 Press MENU to select the U-to-V/U-to-W phase difference setting mode. This causes the following display to appear.

```
PHASE     120deg   240deg
            U-V        U-W
```

F1 F2 F3 F4 F5

Step 5 Press F3 (U-V) or F5 (U-W) to select the U-to-V or U-to-W phase difference.

Step 6 Set the phase difference.

Step 7 Press ESC to exit the phase difference setting mode.

7.3.7 Power Line Abnormality Simulation

In the power line abnormality simulation, the following settings are different from those for single-phase operation.

Item		Setting range	Resolution	Setting accuracy
T1	× 1 deg	0 deg to 360 deg	× 1 deg	±1.5 ms
	× 1 ms	0 ms to 999 ms	× 1 ms	±1 ms
T3	× 1	0 ms to 9999 ms	× 1 ms	± (0.1%+1 ms)
V (T3)		0 to rated voltage (three-phase voltage setting)		

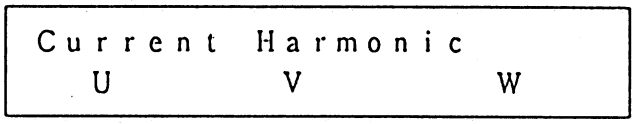
7.3.8 Sequence Operation

None of the items available in DC mode or AC + DC mode can be set from sequence setting mode. AC voltage (Vac) is a voltage setting identical to three phases.

7.3.9 Harmonic Current Analysis Function

The remote controller (RC02-PCR-L) allows harmonic current analysis of the load currents for phases U, V, and W.
The procedure requires the addition of the following step between steps 2 and 3 outlined in 4.4.3, "The Harmonic Current Analysis Function," of the RC02-PCR-L Operation Manual.

Step 2a Select the phase for harmonic current analysis.



- Press F1 (U) to select phase U, F3 (V) to select phase V, or F5 (W) to select phase W.

Then, follow the procedure for step 3 onwards in 4.4.3, "The Harmonic Current Analysis Function," of the RC02-PCR-L Operation Manual.

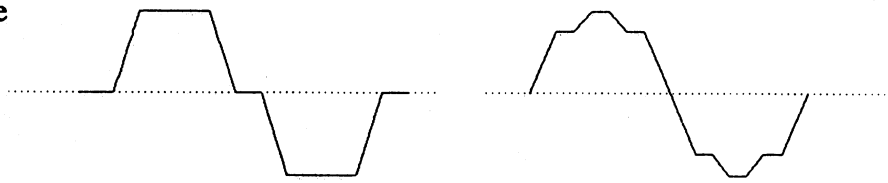
- The selected phase, U, V, or W, is displayed at the upper left of the screen used to display the harmonic current analysis results.

7.3.10 Special Waveform Output Function

The remote controller (RC02-PCR-L) allows the peak clipped waveform of the line voltage to be displayed. However, note that the phase voltage waveform becomes as shown in the figure below.

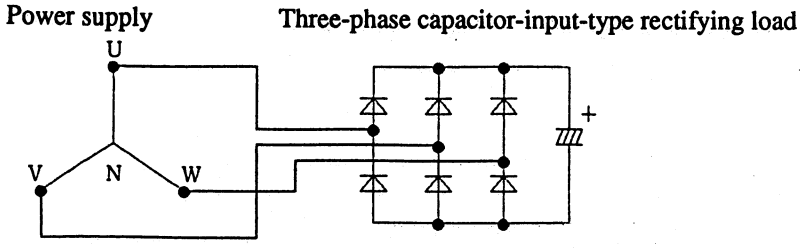
- Setting range is from 1.25 to 1.40.

Line voltage waveform	Phase voltage waveform
U-to-V	U-to-N
V-to-W	V-to-N
W-to-U	W-to-N
	N stands for the neutral point.



Line voltage waveform　　Phase voltage waveform

[Description] A general three-phase capacitor input rectifying circuit is configured as shown below; current flows at the 60 and 120 degree phases of voltage waveform. Therefore, voltage waveform takes the form shown above.



7.4 Use of GP-IB Interface (IB11-PCR-L)/RS-232C Interface (RS11-PCR-L)

This section describes the functions available and procedures required when the GP-IB interface (IB11-PCR-L) or RS-232C interface (RS11-PCR-L) is incorporated into the PCR-LT Series Power Supply.

The following section describes the functions and procedures which are different from those used in the single-phase operation of the PCR-L series power supply and the GP-IB interface or RS-232C interface.
For contents not described in this manual, see the IB11-PCR-L/RS11-PCR-L Operation Manual. Also, be sure to read the IB11-PCR-L/RS11-PCR-L Operation Manual before reading this manual.

7.4.1 Limited Functions

- DC and AC + DC modes

7.4.2 Output Impedance Setting

The PCR-LT Series Power Supply allows the output impedance (output resistance) to be set. The maximum output impedance setting differs with the model number and/or the output voltage range of the PCR-LT Series Power Supplies. The model-based maximum output impedance is as shown in the table below.

Model number	100 V range	200 V range
PCR6000LT	1.00000 Ω	4.00000 Ω
PCR12000LT	0.50000 Ω	2.00000 Ω

7.4.3 Line Voltage/Phase Voltage Display ([VLINE], [VPHASE])

The phase voltage display [VPHASE] command and line voltage display [VLINE] command can be selected in order to display the measured voltage value. These commands require no program data. When the POWER switch is turned ON, the equipment is in phase voltage display.

- When any data other than the initial settings are applied to the U-to-V phase or U-to-W phase, no line voltages can be set.
- Line voltages can be set only in line voltage display mode.
- Power, volt-ampere, and power-factor measurements are available only in phase voltage display mode.

7.4.4 Output Voltage Setting ([VSET], [ACVSET], [LINEVSET])

There are two types of output voltage setting commands; one is for phase voltage setting ([VSET] and [ACVSET] commands) and the other is for line voltage setting ([LINEVSET] command).

- The [VSET] and [ACVSET] commands perform the same operation.
- Setting the output voltage applies the same value to the voltages of all phases.
- The [LINEVSET] command is available only in line voltage display mode.
- The range of the program data in the [VSET] and [ACVSET] commands is the same as that in single-phase operation. The [LINEVSET] command allows the setting of a voltage level 1.73 times the program data of the [VSET] command.

7.4.5 Setting Each Phase Voltage ([UVSET], [VVSET], [WVSET])

U-phase voltage setting ([UVSET] command), V-phase voltage setting ([VVSET] command), and W-phase voltage setting ([WVSET] command) are available to individually set phase voltage.

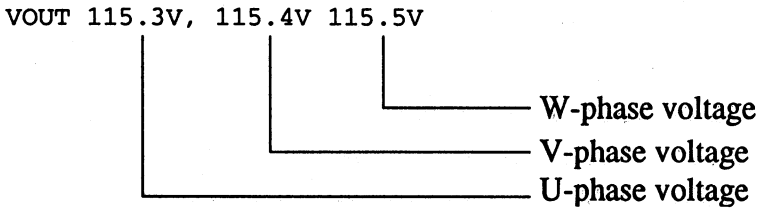
- The [UVSET], [VVSET], and [WVSET] commands are available only in phase voltage display mode.
- The range of the program data in those commands is the same as that in the [VSET] command.

7.4.6 Voltage and Current Measurements ([VOUT?], [IOUT?])

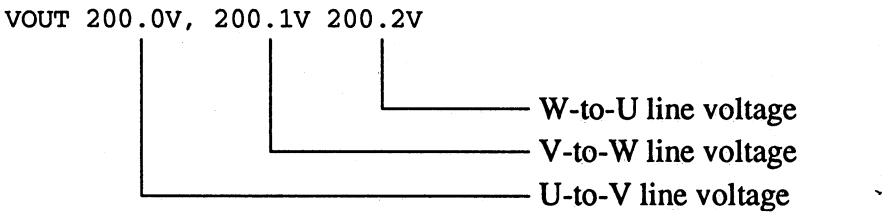
The [VOUT?] and [IOUT?] commands, available in single-phase operation, can be used to read measured voltage or current values.

- The query data of [VOUT?] command shows the U-, V-, and W-phase voltages, separated by commas, in phase voltage display mode or the U-to-V, V-to-W, and W-to-U phase voltages, also separated by commas, in line voltage display mode.

  Example: The query message of [VOUT?] command in the phase voltage display mode

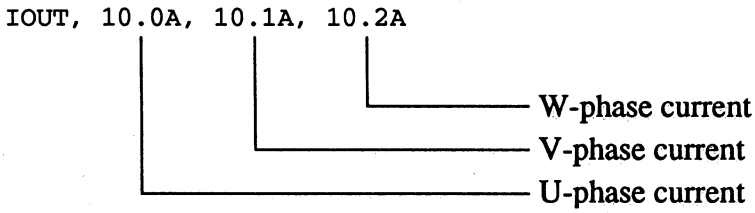


  The query message of [VOUT?] command in the line voltage display mode



- The query data of [IOUT?] command shows U-, V-, and W-phase currents separated by commas.

  Example: The query message of [IOUT?] command

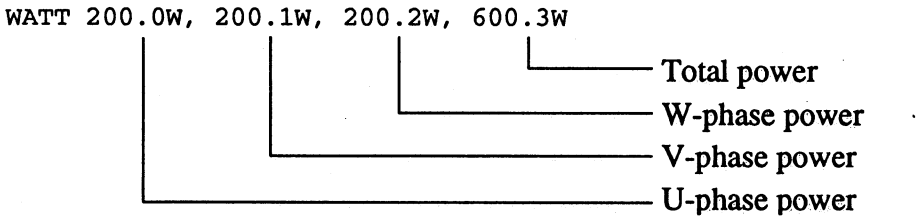


7.4.7 Power, Power-Factor, and Volt-ampere Measurements ([WATT?], [PF?], [VA?])

The [WATT?], [PF?], and [VA?] commands, available in single-phase operation, can be used to read power, power-factor, and volt-ampere measured values.

- These commands are available only in phase voltage display mode.
- The query data shows U-phase, V-phase, W-phase, and total data which are separated by commas.

Example: The query message of [WATT?] command



7.4.8 Setting the U-to-V or U-to-W Phase Difference ([PHASEV], [PHASEW])

The [PHASEV] command is used to set the U-to-V phase difference; the [PHASEW] command is used to set the U-to-W phase difference. The [PHASEV?] and [PHASEW?] commands are used to read the U-to-V or U-to-W phase difference.
Integers values from 0 to 360 can be set for the [PHASEV] and [PHASEW] commands and their defaults at factory shipment are as follows:

Header	Default
[PHASEV]	120
[PHASEW]	240

- The [PHASEV] and [PHASEW] commands are available only in phase voltage display mode.
- If any data other than the defaults is set to U-to-V or U-to-W phase, the line voltage display mode cannot be selected.

Example: `PHASEV 125` Sets U-to-V phase difference to 125 deg.
`PHASEW 238` Sets U-to-W phase difference to 238 deg.

7.4.9 Harmonic Current Analysis Function ([CURHARMA?], [CURHARMP?])

Harmonic current analysis in three-phase operation is performed in the same way as single-phase operation. However, separate commands are used in each phase to read the analyzed data. See the table below and the IB11-PCR-L/RS11-PCR-L Operation Manual.

	Equivalent to [CURHARMA?] command in single phase	Equivalent to [CURHARMP?] command in single phase
Phase U	[UCURHARMA?]	[UCURHARMP?]
Phase V	[VCURHARMA?]	[VCURHARMP?]
Phase W	[WCURHARMA?]	[WCURHARMP?]

7.4.10 Memory Setting Command ([MEMSTO])

DC voltage data (DCV) must always be set to 0 V.
No DC voltage data is output even if it is set.

7.4.11 Power Line Abnormality Simulation Commands

In power line abnormality simulation, the following specifications are different from those used for single-phase operation.

Item		Setting range	Resolution	Setting accuracy
T1	× 1 deg	0 deg to 360 deg	1 deg	±1.5 ms
	× 1 ms	0 ms to 999 ms	1 ms	±1 ms
T3	× 1	0 ms to 9999 ms	1 ms	± (0.1%+1 ms)
V (T3)		0 to rated voltage (three-phase voltage setting)		

7.4.12 Sequence Operation

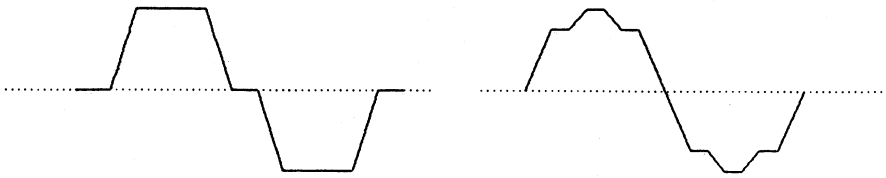
DC voltage data (DCV) must always be set to 0 V.
No DC voltage data is output even if it is set.
Three-phase voltage is set for AC voltage data (ACV).

7.4.13 Setting Peak-Clipped Waveform ([WAVEPC])

A peak-clipped waveform for the line voltage can be output. However, note that the phase voltage waveform takes the form shown below.

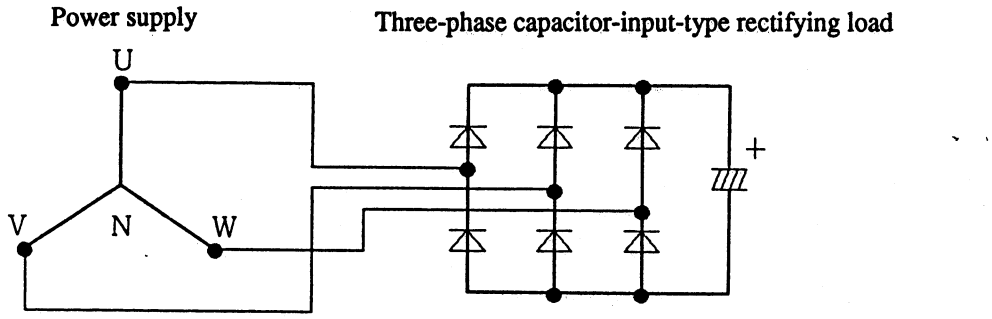
- Setting range is 1.25 to 1.40.

Line voltage waveform	Phase voltage waveform
U-to-V	U-to-N
V-to-W	V-to-N
W-to-U	W-to-N
	N stands for the neutral point.



Line voltage waveform Phase voltage waveform

[Description] A general three-phase capacitor input rectifying circuit is configured as shown below; current flows at the 60 and 120 degree phases of the voltage waveform. Therefore, the voltage waveform takes the form shown above.



7.4.14 Writing User-Defined Waveform Data ([WAVEU], [WAVEV], [WAVEW])

U-phase write ([WAVEU] command), V-phase write ([WAVEV] command), and W-phase write ([WAVEW] command) are available to directly write data to the waveform bank during three-phase output.

Chapter 8

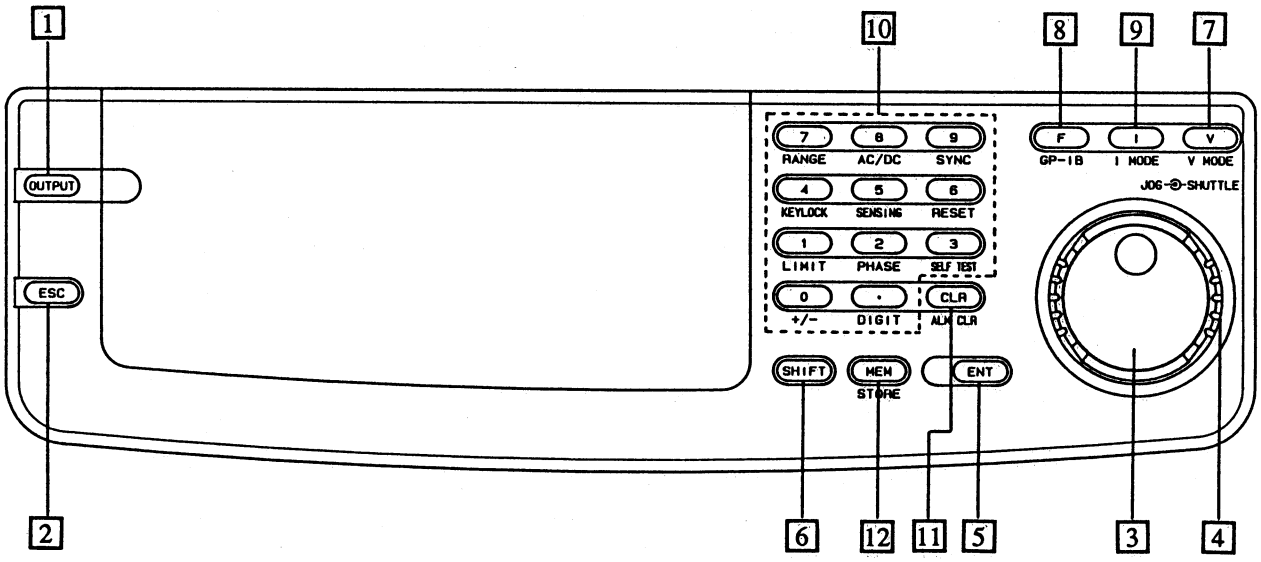
PART NAMES AND OPERATIONS

Denotes the part names of the PCR-LT series AC power supplies and describes the functions of the parts.

Contents

8.1 Front Panel

8.1.1 Control Panel Operating Section



1 OUTPUT

Selects output ON/OFF. (Whenever this switch is pressed, output ON/OFF is switched alternately.) The output status is indicated by the ON/OFF indication at the upper-left side of the control panel. Immediately after the POWER switch is ON, output is OFF.

2 ESC

Used to end or cancel each operation.

3 JOG

Used to set numbers for, for example, voltage and frequency. This is a rotary encoder with 10 clicks per rotation. The encoder increases the set value when it is turned clockwise or decreases the set value when it is turned counterclockwise.

4 SHUTTLE

Used to set numbers for, for example, voltage and frequency. You can choose four levels by setting the change speed, which varies with the angle to which the SHUTTLE is turned. The set value increases when the SHUTTLE is turned clockwise and decreases when it is turned counterclockwise.

5 ENT

Establishes the key operation.
ENT blinks during ENT wait.

6 SHIFT

Enables the function set out in blue letters below each key.
To use such a function, press SHIFT, and then press the relevant key. If SHIFT is pressed, SHIFT in the display panel lights up.

[7] V

Selects the voltage setting mode or the voltage limit setting mode. When any of these modes is selected, the yellow frame encircling the voltage display area lights up.

SHIFT + V (V MODE)

Switches the voltage display mode. The voltage display mode includes the set voltage (SET), rms value (RMS), and peak value (PEAK).

[8] F

Selects the frequency setting mode or the frequency limit setting mode.
If one of these modes is selected, the yellow frame encircling the frequency display area lights up.

SHIFT + F (GP-IB)

Used to change the option setting when an option is used. For further details, see the operation manual for each option.

[9] I

Selects the current limit setting mode. When the mode is selected, the yellow frame encircling the current display area lights up.

SHIFT + I (I MODE)

Switches the current display mode. The current display mode includes the rms value (RMS), peak value (PEAK), and power (W).

[10] 0, 1, 2, ... 9 (numeric keys), and .

Used to directly enter the voltage, current, and frequency values. (. : Decimal point)
A value entered is established when ENT is pressed or is canceled when ESC is pressed.

SHIFT + 0 (+/-)

Not used.

SHIFT + 1 (LIMIT)

Selects the limit value display mode for voltage, frequency, and current. When this mode is selected, the LIMIT above the current display area and the HIGH LIMIT or LOW LIMIT above the voltage display and frequency display areas lights up. The yellow frame encircling one of these display areas also lights up.

SHIFT + 2 (PHASE)

- Used to select either phase voltage or line voltage display mode or to select either output phase voltage or output line voltage for display in the voltage display area.
- Used to select the output phase current for display in the current display area.

SHIFT + 3 (SELF TEST)

Used to select the self-test mode in the event of an alarm or overload. If this mode is selected, SELF TEST in the control panel lights up. At the same time, the current display area indicates "No." and a number, while the voltage display area indicates "Ad." and a number.

SHIFT + 4 (KEYLOCK)

Selects the key lock mode. The key lock mode is also available when the Remote Controller (RC02-PCR-L) is used. In the key lock mode, KEY LOCK lights up and all keys except OUTPUT and SHIFT + 4 (KEYLOCK) keys are disabled.

SHIFT + 5 (SENSING)

Not used.

SHIFT + 6 (RESET)

Resets the equipment.
When a reset is made, all set values return to their Initial Setup Status (factory shipment status).

- A reset can be established by pressing SHIFT + ENT.

SHIFT + 7 (RANGE)

Selects the output voltage range. "100V" below the RANGE indication lights up in the 100 V range and "200V" lights up in the 200 V range.

- When SHIFT + 7 is pressed, the range indication to be selected blinks. Pressing ENT will determine the mode selection.

SHIFT + 8 (AC/DC)

Not used.

SHIFT + 9 (SYNC)

Performs synchronous operation. When synchronous operation is selected, SYNC in the control panel lights up.

SHIFT + . (DIGIT)

Selects the digit mode that enables arbitrary and higher digits to change in the voltage setting or frequency setting mode.
In the digit mode, part (cursor) of the yellow frame encircling the voltage display or frequency display area blinks, thereby allowing the relevant and higher (left of the relevant digit) digits to change.

- Whenever SHIFT + . (DIGIT) is pressed, the cursor moves to the left.

[11] CLR

Cancels the set value and calls the previous value.

SHIFT + CLR (ALM CLR)

Clears the alarm status in the event of an alarm.

[12] MEM

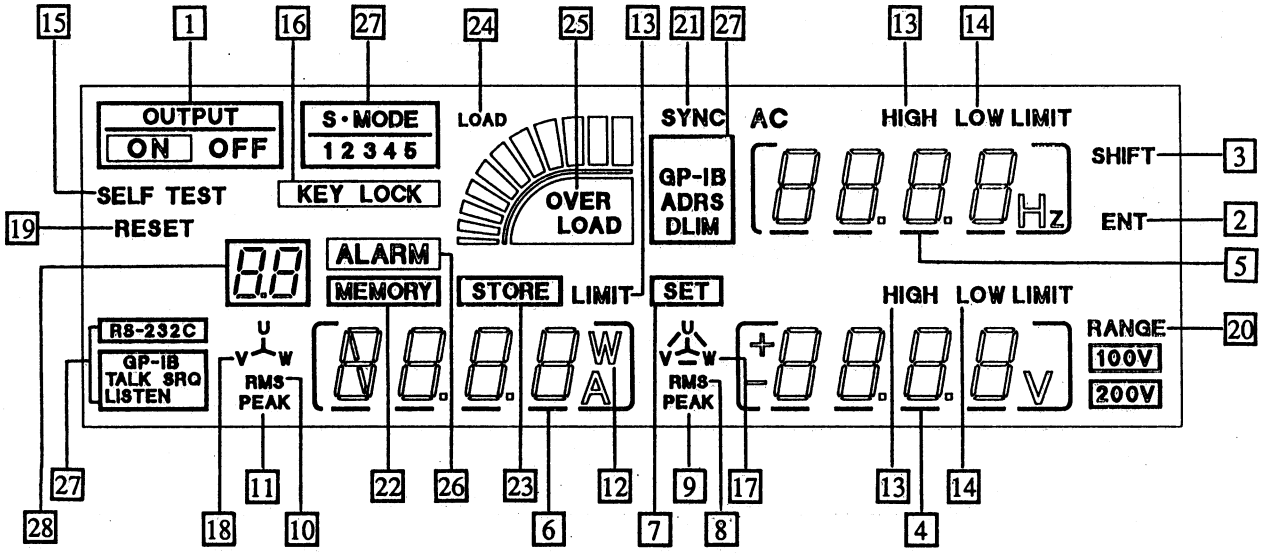
Calls voltage (and frequency) values from the memory.
Pressing MEM and then any of 1 to 9 keys to select a memory address will cause "Ad. X" (X: memory address) to appear in the current display area and will call the voltage (and frequency) stored in the relevant memory address to the voltage display (and frequency display) area (or areas).

- Pressing ENT establishes the voltage (and frequency) called.

SHIFT + MEM (STORE)

Writes the voltage (and frequency) value (or values) in the memory.
Set the voltage (and frequency) you wish to store and press SHIFT + MEM (STORE). Then press any of keys 1 to 9 to select the memory address. After that press ENT. This will store the value or values in the memory.

8.1.2 Control Panel Display Unit



[1] OUTPUT ON/OFF

ON lights up when the output is set to ON, and OFF lights up when it is set to OFF. Immediately after the POWER switch is turned ON, output is OFF. When OUTPUT is pressed, output ON/OFF changes alternately.

[2] ENT

Blinks before operation or before a set value is established. The status in which ENT is blinking is called ENT wait.

[3] SHIFT

Lights up when the SHIFT key is pressed. (Shift mode)

[4] Voltage display area

Displays the voltage value, etc.

[5] Frequency display area

Displays the frequency value, etc.

[6] Current display area

Displays the current value, etc.

[7] SET

Lights up when the set voltage is displayed in the voltage display area.

[8] RMS

Lights up when the value displayed in the voltage display area is rms.

[9] PEAK

Lights up when the value displayed in the voltage display area is the peak value.

[10] RMS

Lights up when the value displayed in the current display area is rms.

[11] PEAK

Lights up when the value displayed in the current display area is the peak value.

[12] W

Lights up when the value displayed in the current display area is a value of power.

[13] HIGH LIMIT/LIMIT

Lights up when the high limit setting mode is selected.

[14] LOW LIMIT

Lights up when the low limit setting mode is selected.

[15] SELF TEST

Blinks in the self-test mode.
In the self-test mode, the current display area displays "No." and a number, and the voltage display area "Ad." and a number.

[16] KEYLOCK

Lights up in the key lock mode.
In the key lock mode, no keys other than the OUTPUT and SHIFT + 4 (KEYLOCK) keys can be used.

[17] 

and the letter of the output phase to be displayed in the voltage display area are lit during phase voltage display mode.

and the letters of the output line to be displayed in the voltage display area are lit during line voltage display mode.

[18] 

and the letter of the output phase to be displayed in the current display area are lit.

[19] RESET

Blinks together with ENT when the SHIFT + RESET keys are pressed.
Pressing the SHIFT + ENT keys in this status will reset the equipment, returning all the set values to their initial setup status (factory shipment status).

[20] RANGE

Displays the output voltage range.
"100V" below the RANGE indication lights up when the 100 V range is selected, and "200V" lights up when the 200 V range is selected.

[21] SYNC

Lights up during synchronous action execution.
- This also blinks if the synchronous action is not satisfactory.

[22] MEMORY

Lights up during memory write/read execution.

23 STORE

Lights up when data is written into the memory.

24 LOAD

Displays the ratio of a load current value to the rated current value as guidance.

25 OVERLOAD

Lights up if overload (over current) occurs. If this condition continues for a few seconds, the output is set to OFF and alarm is generated, sounding an intermittent buzzer tone.

26 ALARM

Lights up when the intermittent buzzer tone is generated in the event of an alarm.

27 S-MODE RS-232C GP-IB TALK SRQ LISTEN GP-IB ADRS DLIM

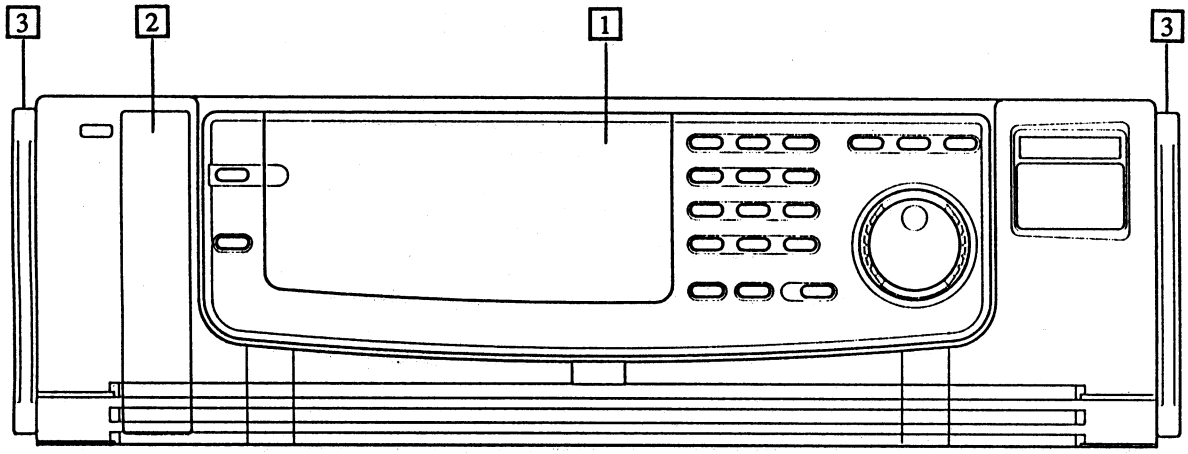
Lights when an option is used.
However, once an option is used, this indication may be lit even when such option is disconnected.
For further details about this, see the operation manual of the relevant option.

28 E3

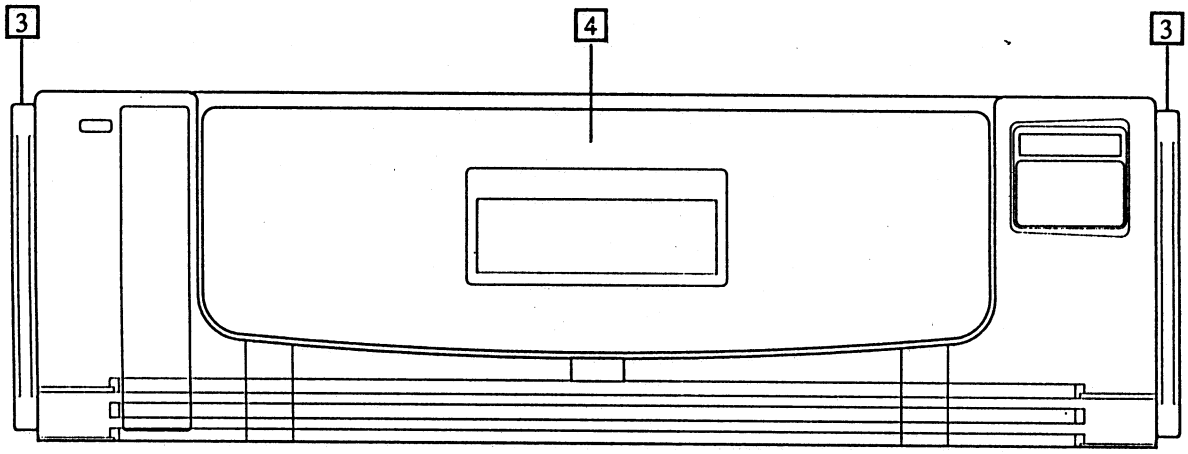
Appears if the current display area shows more than 10 kW in power value indication.

8.1.3 Front Panel Upper Part

PCR6000LT or PCR12000LT U-phase equipment



PCR12000LT V- or W-phase equipment



[1] Control panel

[2] SLOT1

Allows optional board connection.

[3] Grips

Use the grips to move the equipment along a flat place only.

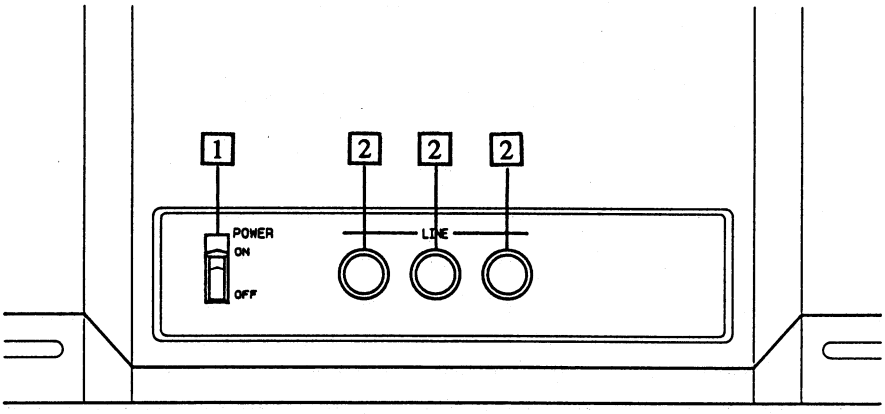
(WARNING) *Never attempt to use a grip or grips to lift up the equipment.*

[4] Drawer

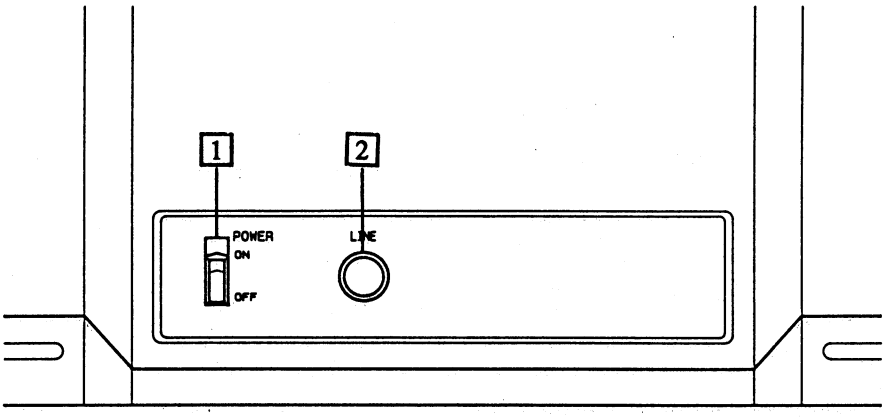
For containing the Operation Manual and options.

8.1.4 Front Panel Lower Part

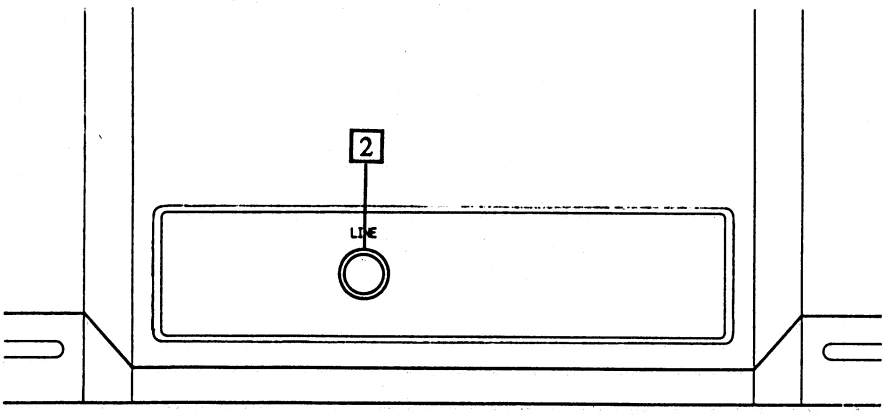
PCR6000LT



PCR12000LT U-phase equipment



PCR12000LT V- or W-phase equipment



[1] POWER

The equipment's power switch.
Inclining the lever up turns the POWER switch ON, while inclining the lever down turns the switch OFF.
The equipment stores the following value. When the POWER switch is turned ON, the equipment starts up with the set values applied immediately before the POWER switch was turned OFF.

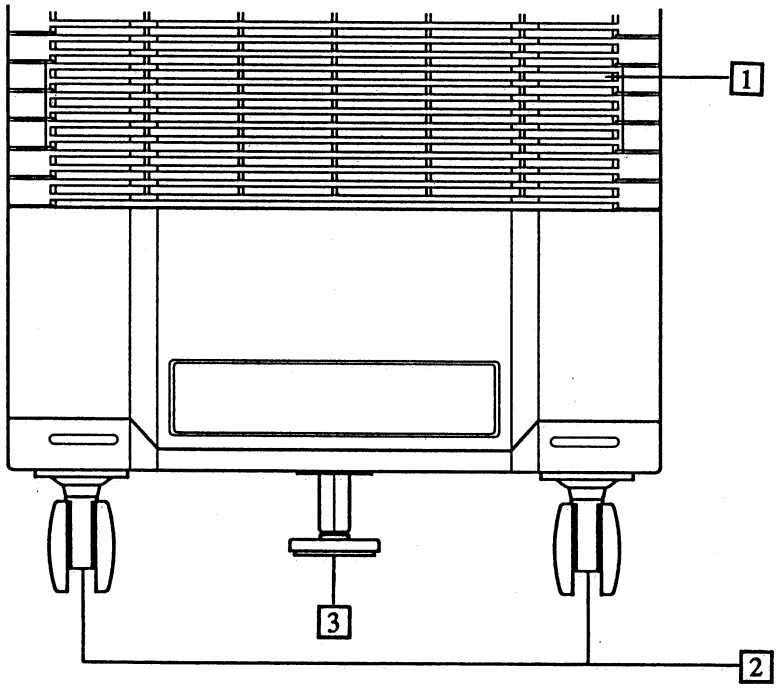
- Output voltage and frequency set values
- Output voltage range (100 V/200 V)
- Output voltage, frequency, and current limit values
- Voltage, current, and power display modes
- Key lock

[2] LINE lamp

This lamp lights up when input power is fed into the INPUT terminal board.

(WARNING) *This lamp lights up regardless of the POWER switch ON/OFF. When this lamp is lit, voltage is being applied to the INPUT terminal board. Therefore, do not touch the INPUT terminal board.*

8.1.5 Air-Intake, Casters, and Others



[1] Air-intake

For cooling the inside of the equipment. The built-in air filters require periodic cleaning.

[2] Casters

Four casters are provided, which allows the equipment to be moved in any direction. The casters have a lock mechanism, which temporarily fixes the equipment onto the floor.

(Caution) *To fix the equipment, always use the stopper described below, together with the caster locks.*

[3] Stopper

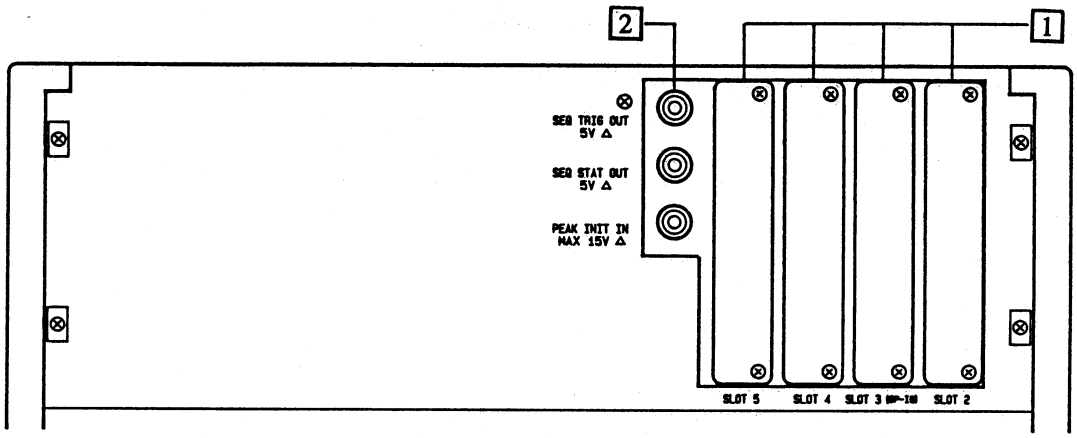
Used to fix the equipment on the flat floor.

(Caution) *When installing the equipment, always apply the stopper.*

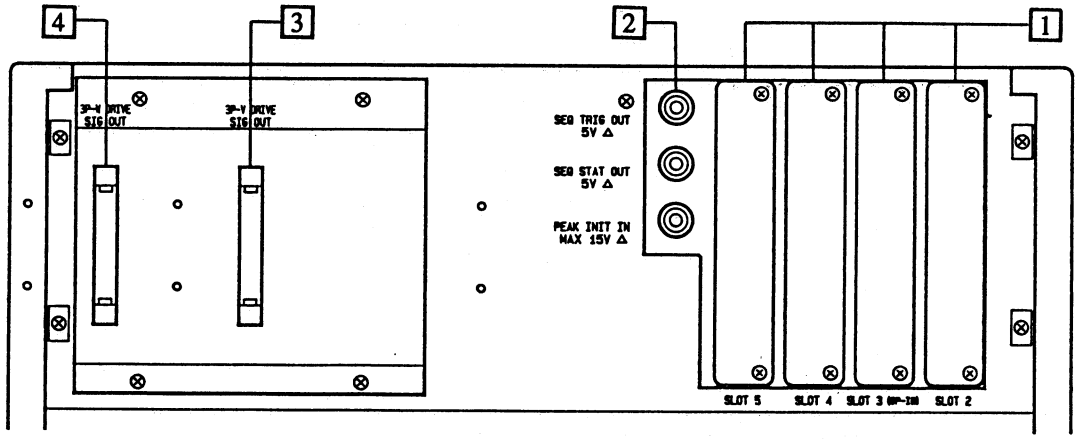
8.2 Rear Panel

8.2.1 Rear Panel Upper Part

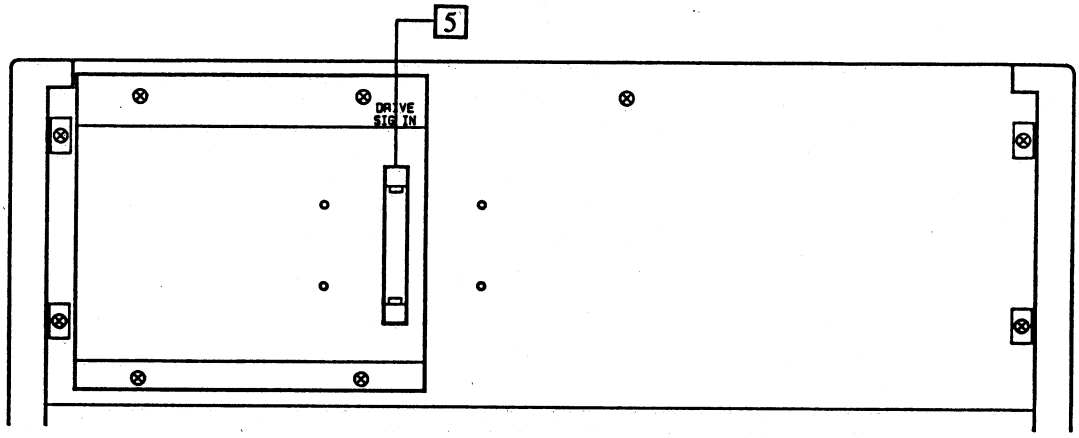
PCR6000LT



PCR12000LT U-phase equipment



PCR12000LT V- or W-phase equipment



[1] SLOT2, SLOT3 (GP-IB), SLOT4, and SLOT5

Used for inserting an optional board.

[2] BNC connectors

These connectors become functional when an option is being used.

[3] 3P-V DRIVE SIG OUT

Used to connect the SIG cable.

[4] 3P-W DRIVE SIG OUT

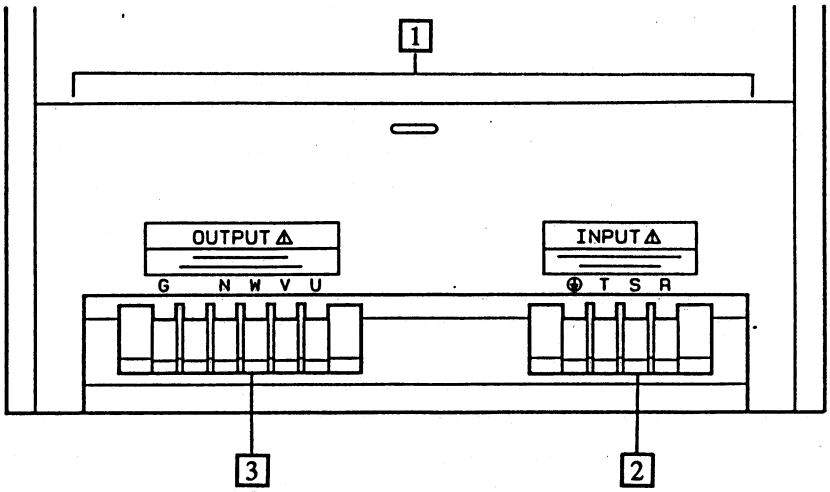
Used to connect the SIG cable.

[5] DRIVE SIG IN

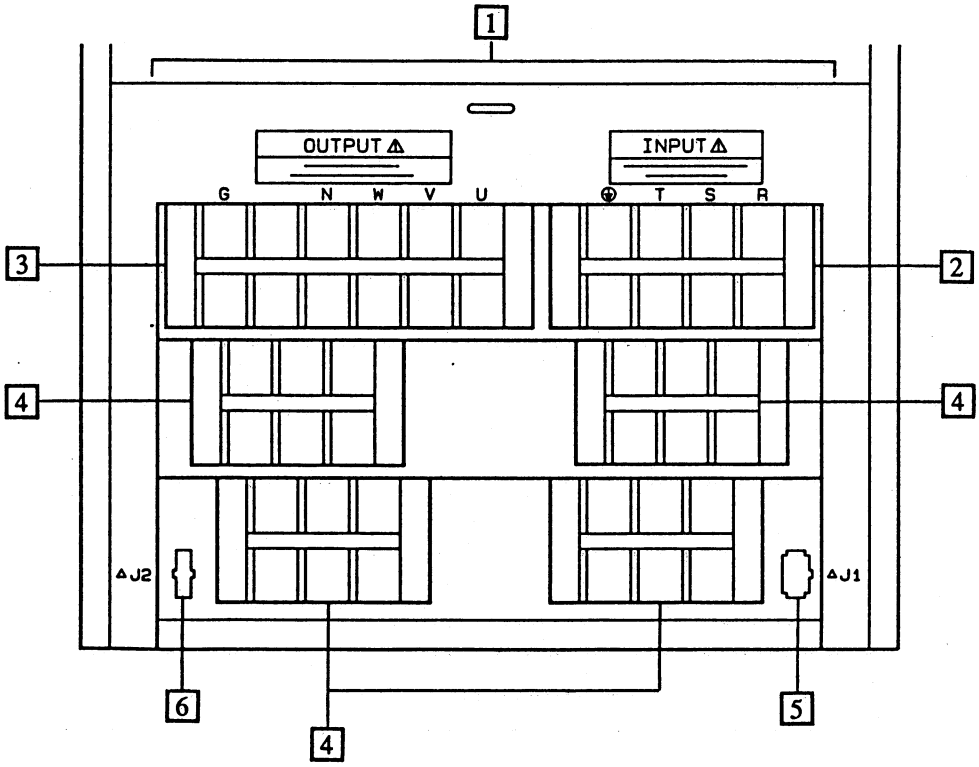
Used to connect the SIG cable.

8.2.2 Rear Panel Lower Part

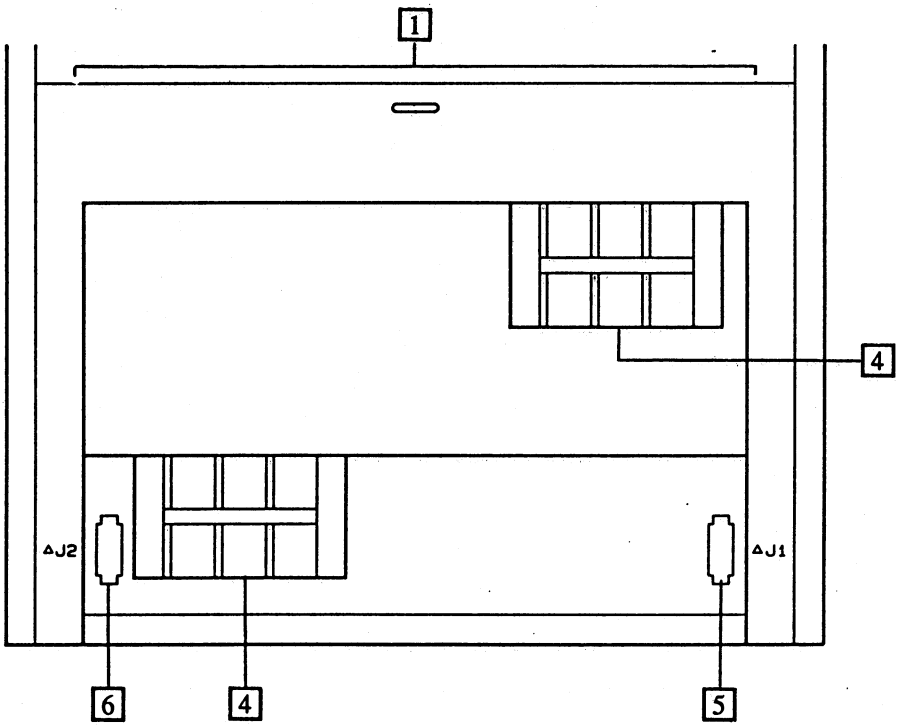
PCR6000LT



PCR12000LT U-phase equipment



PCR12000LT V- or W-phase equipment



[1] Terminal box

Incorporates the INPUT, OUTPUT, and linking terminal boards.

[2] INPUT terminal board

Used to connect input power.

(WARNING) *Before connecting an input power cable, always cut off power feed from the power distribution board.*

(Caution) *Use of the equipment outside of the rated input voltage range may cause problem.*

[3] OUTPUT terminal board

Used to connect a load.

(WARNING) *Before connecting an output power cable, always cut off the power feed from the power distribution board.*

[4] Linking terminal board

Used to connect a power connection cable.

[5] J1

Used to connect the power supply connection cable.

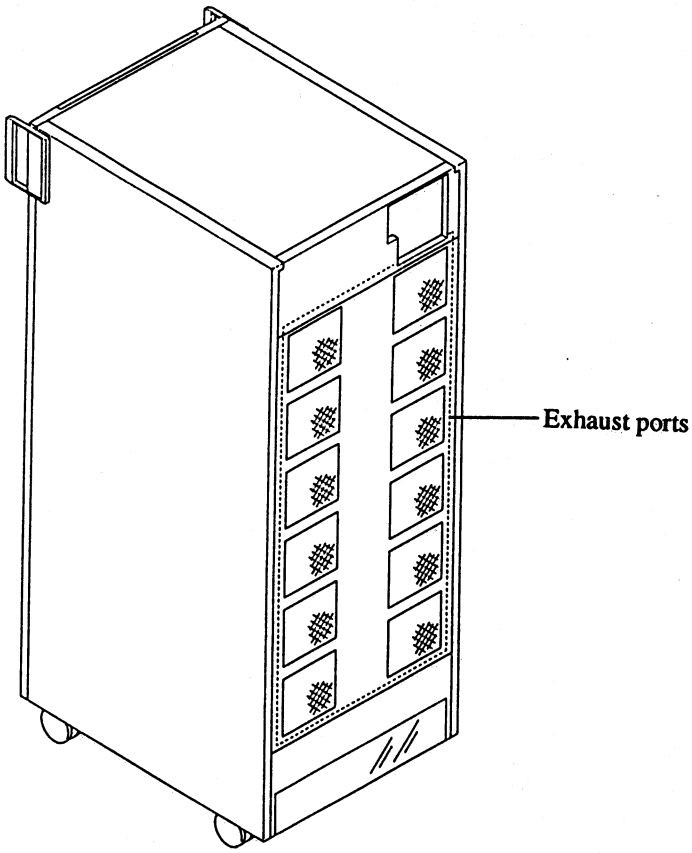
[6] J2

Used to connect a power connection cable.

8.2.3 Exhaust Ports

The exhaust ports are provided to cool the inside of the equipment with air.

(Caution) *Set up the equipment at least 20 cm distance from the wall, and do not place anything within 20 cm of the exhaust port.*



Chapter 9

PROTECTIVE FUNCTIONS AND THEIR OPERATIONS

Describes the protective functions and their operations.

Contents

9.1 Types of Protective Functions

This equipment has the following protective functions.

	Protective function name	Display/Symptom
For internal circuit protection	Input voltage range protection	Error (5) is generated.
	Overheat protection	Alarm (2) is generated.
	Internal circuit protection	Alarm is generated.
For load protection and internal circuit protection	Overload protection (current limitting)	OVERLOAD lights up. Alarm (6) is generated.
	Overload protection (internal semiconductor protection)	OVERLOAD lights up. Alarm (3) is generated.

9.2 Measures to be Taken in the Event of an Alarm

This section describes the possible causes of an alarm and measures to be taken.

If the equipment is operating in an unsuitable environment or if an error occurs inside the equipment, an intermittent buzzer tone will sound and "ALARM" will light up or "Err X" (X:number) will appear. (For an Err X display, no buzzer tone sounds.) In such a case, the protective function relevant to the cause of error will operate to prevent an escalation of the problem and to protect a connected load from breakage.
If an alarm sounds, the equipment always sets the output OFF. These may not be a problem in the equipment, depending on alarm type. In such a case, release the alarm, and use the equipment as usual.

Steps to be Taken if ALARM Lights Up

Step 1 Turn the POWER switch OFF and wait for more than 5 seconds, then turn the switch ON again.

- If no alarm occurs in this case, the equipment can continue to be used.
- If an alarm occurs again, check the type of alarm in accordance with the SELF TEST described below and take the appropriate steps to deal with such an alarm.

Alarm-type Checking Procedure (SELF TEST)

Step 1 If ALARM lights up, press SHIFT + 3 (SELF TEST).
This will cause "No. X" to appear in the current display area and "Ad. X" to appear in the voltage display area. The mark ⅄ and letter U, V, or W at the left of the voltage display area indicate a phase involved in self-testing.

Step 2 Turn JOG. This will cause the contents in the current and voltage display areas to change. Then read a number in the "No." area when "Ad. 0" appears.

Step 3 Apply the measure corresponding to the displayed "No." in accordance with the table below. The numbers in the "Ad." and "No." areas displayed in SELF TEST have the following meaning.

Ad.: Indicates the internal location of the equipment. "0" indicates the entire section of the equipment. The number or numbers to be displayed other than 0 will differ as follows, depending on the model.
PCR6000LT : 1 to 2
PCR12000LT: 1 to 4
These numbers indicate the positions of the internal power units. The power units are numbered sequentially from top to down.
For PCR6000LT power units, U-phase No. 1 and No. 2, V-phase No. 1 and No. 2, and W-phase No. 1 and No. 2 are assigned in that order.

No.: Indicates the cause of the alarm (see the table below). When requesting a repair, inform us of this number.

No.	Description/Solution
0	No alarm
1	The internal circuit protective function has activated. Contact your Kikusui agent.
2	The internal temperature is expected to be abnormally high. Wait for about 10 minutes with the power ON. If the alarm goes off, the equipment may be installed inappropriately. Read 2.2 Installation and Location again to make corrections. If the alarm continues, read 2.4 Checking the Input Power again. If nothing is wrong, contact your Kikusui agent.
3	The internal semiconductor protective function has activated. See 9.3 Overload Protective Function.
4	The internal circuit protective function has activated. Contact your Kikusui agent.
5	The internal circuit protective function has activated. Contact your Kikusui agent.
6	The current limiting function has activated. See 9.3 Overload Protective Function.
7	No alarm.
8	The wiring between the U-, V-, and W-phase power supplies may be incorrect. Check the cable connections, referring to 3.1, "Wiring between U-, V-, and W-phase Power Supplies," and then turn the power switches ON again. If the alarm is still ON, an internal power unit has possibly been removed for repair, etc. Clear the alarm.

Alarm Clear Procedure

When an alarm (8) has occurred, clear it in the following procedure.

Step 1 Press SHIFT + CLR (ALM CLR).

Step 2 When the intermittent buzzer sound stops and the alarm indication goes off, press SHIFT + 3 (SELF TEST) again to check the alarm type.

Step 3 Check for the presence of alarm of each phase as to "Ad. 1" to the last number (the last Ad. number will differ depending on the model).
If there is no alarm, the equipment can continue to be used.

If an alarm occurs in all power units of each phase, the equipment cannot be used. Contact your Kikusui agent.

Before clearing the alarm

If there are Ad.s where alarm occurred and Ad.s where no alarm occurs, calculate phase-basis output power and current using the following equations based on the number of Ad. s where no alarm occurs for each phase, Na, and the number of Ad. s for the model, Nb. Clear the alarms. The equipment can then be used again. However, always request a repair.

Applicable power = Rated power × Na + Nb
Applicable current = Rated current × Na + Nb

Example: For PCR6000LT, Nb = 2
The number of Ad.s when no alarm of U-phase occurs is 1, Na = 1.
The number of Ad.s when no alarm of V-phase occurs is 2, Na = 2.
The number of Ad.s when no alarm of W-phase occurs is 2, Na = 2.

Applicable U-phase power = 2000 × 1 + 2 = 1000[W]
Applicable U-phase current = 20 × Na + Nb (100 V range) = 10[A]
Applicable V-phase power = 2000 × 2 + 2 = 2000[W]
Applicable V-phase current = 20 × Na + Nb (100 V range) = 20[A]
Applicable W-phase power = 2000 × 2 + 2 = 2000[W]
Applicable W-phase current = 20 × Na + Nb (100 V range) = 20[A]

Example: For PCR12000LT, Nb = 4
The number of Ad.s when no alarm of U-phase occurs is 2, Na = 2.
The number of Ad.s when no alarm of V-phase occurs is 4, Na =4.
The number of Ad.s when no alarm of W-phase occurs is 0, Na = 0.

Applicable U-phase current = 40 × 2 + 4 (100 V range) = 20[A]
Applicable V-phase current = 40 × 4 + 4 (100 V range) = 40 [A]

Phase U and V output currents can be calculated as shown above. However, because the alarm occurred in all W-phase power units, the equipment cannot be used. Contact your Kikusui agent.

Caution *Clearing an alarm will cause the output voltage set value to become 0 V.*

Check to be Made if "Err X" Appears

If there is an error as described in the table below, the control panel will continue displaying "Err X (X: number)."

No.	Measures
1	All internal power units are defective. Contact your Kikusui agent.
4	Turn the POWER switch OFF and wait for more than 5 seconds. Then turn the POWER switch ON, keeping MEM pressed to reset. This will call up the initial setup status.
5	Input voltage is outside the rated range. See Section 2.3 Checking the Input Power.
Other numbers	Contact your Kikusui agent.

9.3 Overload Protective Function

This equipment has two types of overload protective functions.
One is the current limiting function that applies if the equipment's output current exceeds the current limit value (maximum setting: 1.1 times the rated output current). If a current exceeding the current limit flows in a load, OVERLOAD will light up, causing the output voltage to drop. If this status continues for either 10 sec, the current limiting function will automatically turn the output OFF. For further details, see 6.5.3 Setting the Current Limit Value.
The other is the function that is activated if the equipment's internal semiconductor protective circuit is activated. As long as the using method of the equipment agrees with the specifications, the internal semiconductor protective function will not usually operate. However, in the event of an instantaneous overcurrent such as a rush current, the internal semiconductor protective function will operate and if such a status continues about 1 sec, an overload will occur.

Caution

- *Even if the internal semiconductor protective function is activated, an overload will not occur for about 1 sec.. However, the output voltage waveform will be distorted to protect the semiconductor during the operation of this protective function.*
- *Even if no overload occurs, frequent operation of the internal semiconductor protective function may cause a problem in the equipment.*
- *Always use the equipment in such a way that the internal semiconductor protective function is activated at more than one-minute intervals.*

Whether an overload has been caused by the current limiting function or by the internal semiconductor protective function can be checked as follows:

Overload Cause Checking Procedure

Step 1 While the output is OFF and OVERLOAD is lit, press SHIFT + 3 (SELF TEST). This will cause "No. X" (X: number) to appear in the current display area and "Ad. X" (X: number) to appear in the voltage display area.

Step 2 Turn JOG. This will cause the content of the current display area, and the content of the voltage display area to change. Then, when "Ad. 0" appears, read a number indicated by "No."

Examples:
No. 3: Internal semiconductor protective function is activated.
No. 6: Current limiting function is activated.

Measures to be Taken if the Overload Function is Activated

If an overload occurs and continues for a specified time, the output will be turned OFF, generating an intermittent buzzer sound and causing OVERLOAD to light up.
In such a case, eliminate the cause of the overload and press OUTPUT again. This will cancel the overload display status and set the output ON. If the cause of the overload has not been eliminated, the overload will recur after a specified time.

(*Caution*) • *If an overload occurs, always eliminate its cause, then press OUTPUT. Frequent recurrence of overload may cause a problem.*

Specific Examples of Overload Causes and Solutions

① For a linear load

Overload actuating condition	Solution
If the voltage drops as shown in Fig. A when the output current is increased gradually, this means that the current limiting function has activated. If the output voltage waveform is distorted as shown in Fig. B, this means that the internal semiconductor protective function has activated.	• If the current limit value is set low, change the set value. • If the rated current has been exceeded, reduce the load capacity. • If the power factor is low (lagged phase), use a phase-advancing capacitor to increase the power factor. • If the power factor is low (lead phase), use a dummy resistance in parallel to increase the power factor.
If the output voltage waveform is distorted as shown in Figs. B and C when the output current is increased rapidly, this means that the internal semiconductor protective function has activated.	

② For capacitor-input-type rectifying load

Overload actuating condition	Solution
If the voltage drops as shown in Fig. A when the output current is increased, this means that the output current (rms value) has exceeded the current limit value. That is, the current limiting function has activated.	• If the current limit value has been set, change that set value. • If the rated current has been exceeded, reduce the load capacity.
If the output voltage waveform is distorted as shown in Fig. C when output current is increased, the output peak current has activated the internal semiconductor protective function.	• Reduce the peak current.

③ For a load which draws a rush current

Overload actuating condition	Solution
If the voltage waveform is distorted as shown in Fig. C when voltage is applied to a load or when the voltage is changed suddenly, a rush current has activated the internal semiconductor protective function.	• Reduce the rush current.

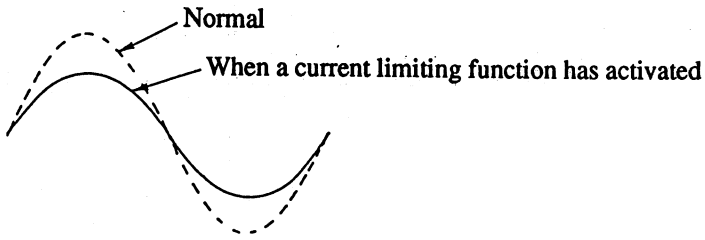


Fig.A

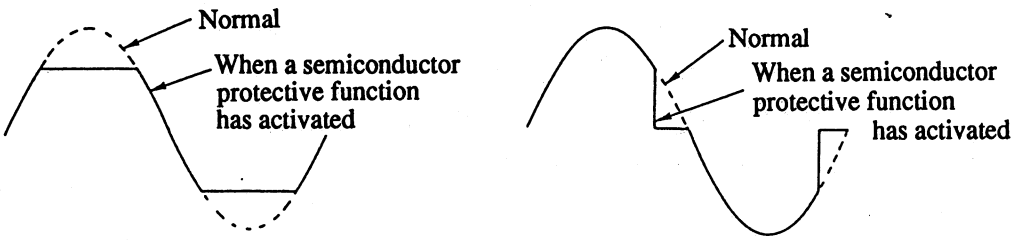


Fig.B

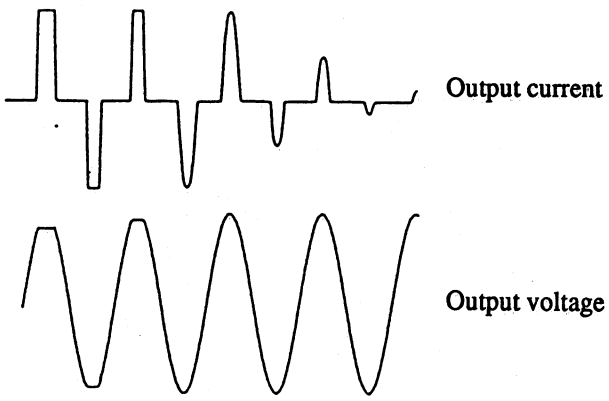


Fig.C

Chapter 10
MAINTENANCE

Describes how to maintain and control the equipment and cleaning methods.

Contents

10.1 Before Requesting a Repair

If a problem occurs in the equipment, check that problem in accordance with the following table. If it is not possible to recover a normal status, contact your Kikusui agent to request repairs.

Problem	Check items	Results	Possible causes
LINE lamp does not light up.	Check if the rated voltage is being applied to the INPUT terminal board.	NO	• Input power cable has been improperly connected. • Input power cable has been disconnected.
	Ditto	YES	• The equipment is defective.
LINE lamp does not light up.	Check to see if the power cables have been connected.	NO	• Erroneous power cable connection.
	Ditto	YES	• The equipment is defective.
The control panel display unit does not light up even when the POWER switch is turned ON.	Check if the rated voltage is being applied to the INPUT terminal board.	NO	• Input power cable has been improperly connected. • Input power cable has been disconnected.
	Ditto	YES	• The equipment is defective.
Part of or all the sections of the control panel donot operate.	Check if the key lock mode has been activated.	YES	• The key lock function has been inadvertently activated.
	Check if the input voltage is within the rated range.	NO	• The input voltage is improper.
	Check if the ALARM is lit.	YES	• See the next page.
	Check for the existence of a device generating a great deal of noise near the equipment.	YES	• Malfunction has occurred due to noise.
	Check if the GP-IB (IB11-PCR-L) or RS-232C (RS11-PCR-L) Interface has been connected.	YES	• The control panel is under control by GP-IB/ RS-232C Interface.
	Check if the voltage and frequency are within the limit ranges.	NO	• The limit value setting is inappropriate.
	Has the cause of the problem been revealed by checking the above six items?	NO	• The equipment is defective.

Problem	Check items	Results	Possible causes
ALARM lights up. See Chapter 9 PROTECTIVE FUNCTIONS AND THEIR OPERATIONS.	Check if fan has stopped.	YES	• The overheat protective function has activated due to a defective fan.
	Check if an exhaust port or air-intake port is blocked.	YES	• The overheat protective function has activated. • The filter is clogged.
	Check if the ambient temperature is more than 40 °C (104°F.)	YES	• The overheat protective function has activated.
	Check to see if the SIG cables have been connected.	NO	• Unit check error occurred due to erroneous cable connection.
	Check to see if the power supply connection cables have been connected.	NO	• Unit check error occurred due to erroneous cable connection.
	Has the cause of the problem been revealed by checking the above four items?	NO	• The equipment is defective.
The control panel display is not normal.	Check if the input voltage is within the rated range.	NO	• The input voltage is abnormal.
	Check for the existence of a device generating a great deal of noise near the equipment.	YES	• Malfunction has been caused due to noise.
	Check if the S-MODE is lit.	YES	• The setting established for use of an option has been held.
	Has the cause of the problem been revealed by checking the above three items?	NO	• The equipment is defective.
The output voltage waveform is distorted.	Check to see if the SIG cables have been connected.	NO	• Erroneous SIG cable connection
	Check to see if the power supply connection cables have been connected.	NO	• Erroneous power supply cable connection
	Check to see if the power cables have been connected.	NO	• Erroneous power cable connection
	Check if OVERLOAD is lit.	YES	• The overload protective function has activated.
	Ditto	NO	• The equipment is defective.

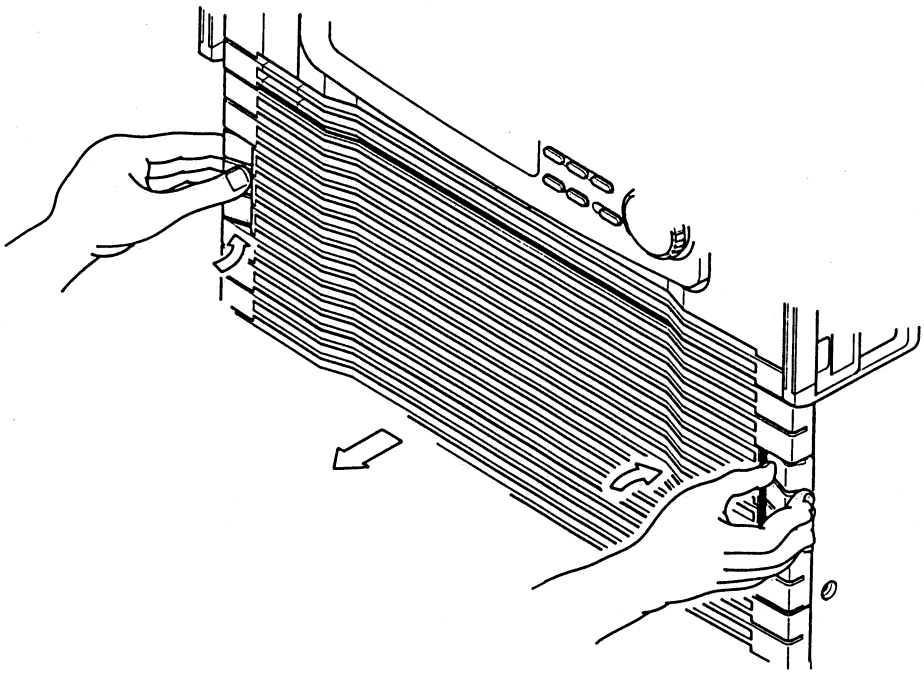
Problem	Check items	Results	Possible causes
The output current cannot be obtained. (OVER LOAD is lit.)	Check if the output voltage range is correct.	NO	• The output voltage range setting is inappropriate.
	Check if load power factor is within the range determined by the specifications.	NO	• The protective circuit has been activated by a capacitor-input-type rectifying load or a nonlinear load.
	Check if current limit has been set to a low level.	YES	• The current limit value setting is inappropriate.
	Has the cause of the problem been revealed by checking the above three items?	NO	• The equipment is defective.
The rated output cannot be obtained.	Check if the neutral point of the load is connected to terminal N on the OUTPUT terminal board, or if the load is connected to the equipment by a three-phase three-wire system (delta connection).	NO	• If all the phase currents do not balance, the rated output may be able to be obtained by a delta connected load.
The output voltage is different from the voltage has been set. (3 times or 1/3 of it)	Check if the display mode is correct.	YES	• The phase voltage is displayed when the phase display mode is set, and the line voltage is displayed when the line display mode is set.
The output current cannot be obtained.	Check to see if the SIG cables have been connected.	NO	• Erroneous SIG cable connection
	Check to see if the power supply connection cables have been connected.	NO	• Erroneous power supply cable connection
	Check to see if the power cables have been connected.	NO	• Erroneous power cable connection
The line voltage cannot be set.	Check if all the phase voltages are the same value.	NO	• Setting condition of the line voltage
	Check if the phase of phase voltage is the initial value.	NO	• Setting condition of the line voltage

10.2 Cleaning the Air-Intake Filters

Clean the air-intake filters periodically to assure proper operation of the equipment.

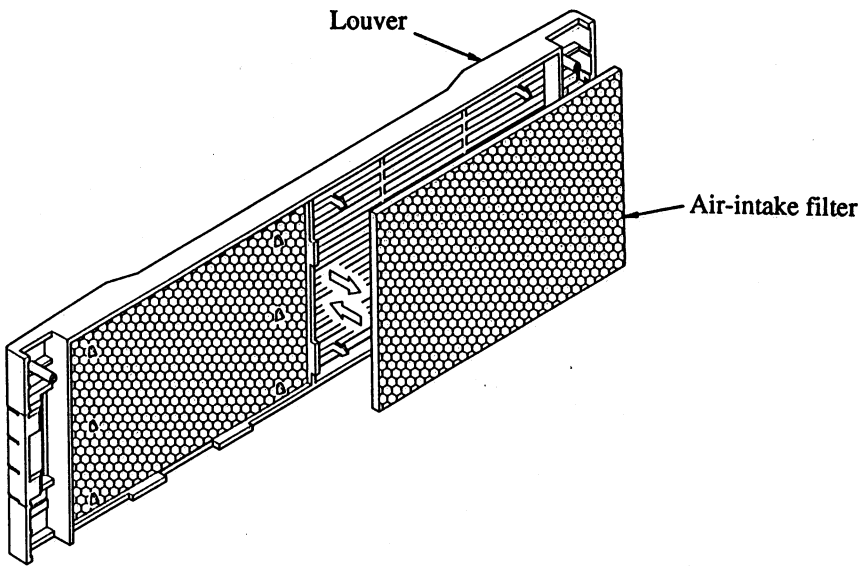
Removing the Louver

Step 1 Press the latches at both ends of the louver and pull the entire louver to remove it from the equipment.



Cleaning the Air-Intake Filter

Step 1 Remove two air-intake filters from the clicks of the louver.



Step 2 Using a cleaner, remove any dust or dirt from the air-intake filters.

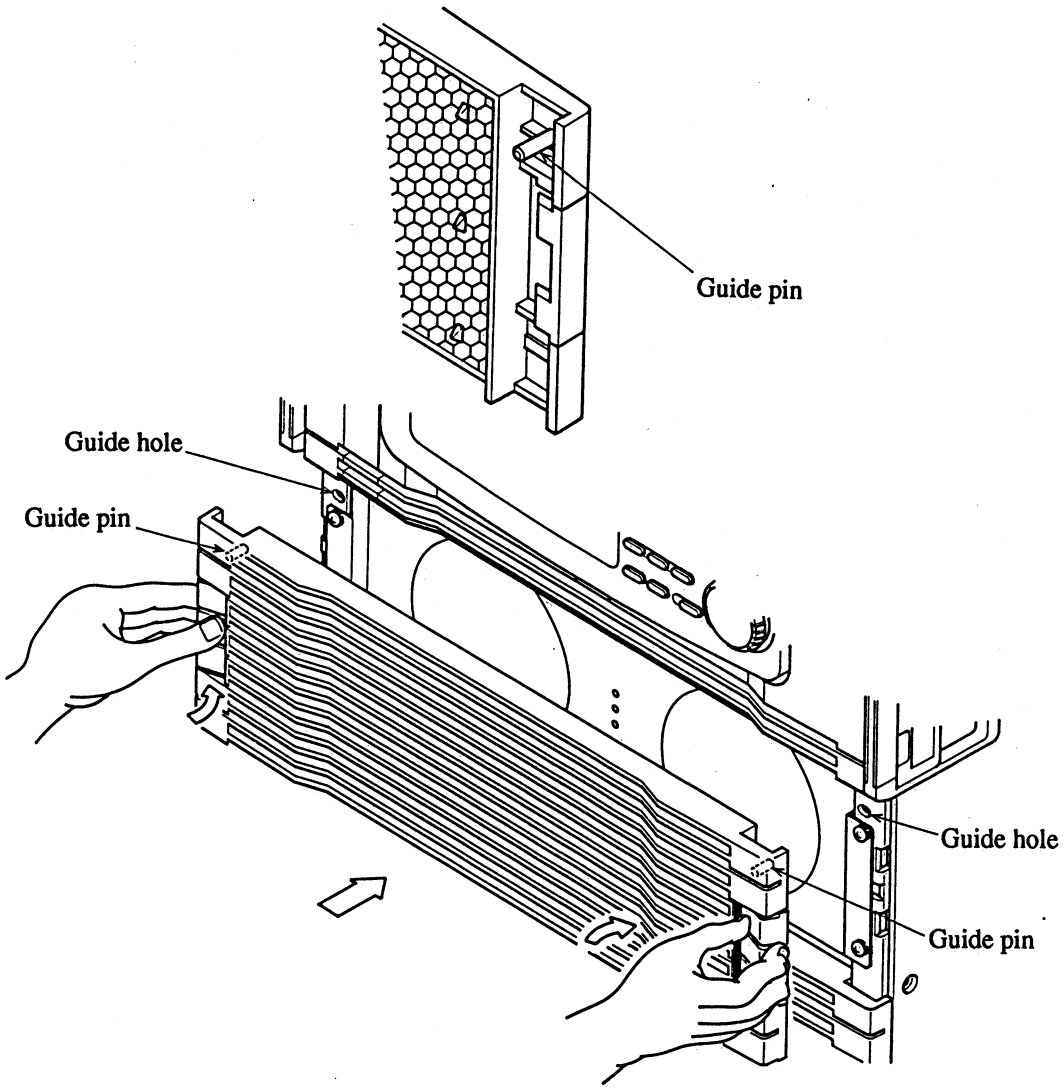
- If a filter is extremely dirty, clean it by using a neutral detergent, and then dry it thoroughly.

Caution *While it is operating, the equipment sucks air through the air-intake filters to cool the inside. Therefore, if an air-intake filter is wet, the humidity inside the equipment will rise, which may cause a problem.*

Step 3 Place the air-intake filters within the louver frame and push the filters so that louver clicks are engaged.

Installing the Louver

Step 1 Check the top and bottom of the louver (the top part has guide pins). Hold both ends of the louver, then align the guide pins to the equipment guide holes.



Step 2 By pushing the latches of the louver, attach the louver to the equipment.

10.3 Limitation on the Number of Update Operations for Home Position Status

The home position status of the power supply (see page 6-2) is backed up by the internal EEPROM and remains intact even if the power switch is turned off. However, there is a limitation on the number of EEPROM update operations.
With normal operating conditions, the life expectancy of the EEPROM is much longer than that of the power supply itself. However, if voltage or frequency setting has been changed frequently, the internal settings may be initialized instead of being backed up when the power switch is turned off, because of the limitation on the number of EEPROM update operations. (For initial setup status, see page 4-6.) If the power supply incurs such a trouble, contact your KIKUSUI agent representative for exchanging the EEPROM.

Description About the number of EEPROM updates

The EEPROM manufacturer guarantees that the EEPROM in the power supply has an error rate of 1% or less after 100,000 times of updates. The power supply updates or backs up the internal settings approximately once every second. However, if there is no difference between the setting data and backup data, no update operation results.
The following are examples of time period until the number of EEPROM updates reaches 100,000 (times) in actual operating conditions.

Example 1: With 20 update operations a day

$10^5 / 20 = 5000$ days (Approx. 14 years)

Example 2: With 200 update operations a day

$10^5 / 200 = 500$ days (Approx. 1.4 years)

Chapter 11

SPECIFICATIONS AND OPERATING CHARACTERISTICS

Shows the specifications and operating characteristics of the equipment.

Contents

11.1 Specifications

Model name			PCR6000LT	PCR12000LT
Input rating (AC rms value)				
Voltage			170 to 250 V	
Number of phases, Frequency			3 ϕ, 47 to 63 Hz	
Apparent power			Approx. 12 kVA	Approx. 24 kVA
Power factor			0.95, typical value (*1)	
Current			42 A or less	83 A or less
Output rating in the phase voltage mode (AC rms value)				
Voltage			1 to 150 V/2 to 300 V (100 V/200 V output range) (*2)	
Maximum current	(*3)		20 A/10 A	40 A/20 A
Number of phases			3 ϕ	
Power capacity			6 kVA	12 kVA
Maximum peak current	(*4)		Four times the maximum current (rms value)	
Load power factor			0 to 1 (lead or lagged phase) (*3)	
Frequency			1 to 999.9 Hz (*3,5)	
Output voltage stability				
Source effect	Changes in the rated range		Within ±0.1%	
Load effect	Changes in the 0 to 100% rating range		Within ±0.5 V (*6)	
Output frequency variation	Changes in the rated range		Within ±1.5% (*7)	
Ambient temperature variations	Changes in the rated range		100 ppm/°C . (typical value) (*8)	
Output frequency stability	Changes in all the rated ranges		Within $\pm 5 \times 10^{-5}$, Setting accuracy: Within $\pm 1 \times 10^{-4}$	
Output voltage waveform distortion factor	(*9)		0.5% or less	
Output voltage response time	(*10)		80 μS. (typical value)	
Efficiency	(*1)		50% or more	
Output phase voltage phase difference	(*11)		Within 120° ± (0.4° + 5 μS) (*12) (within 120° ± (0.4° + fo × 1.8 × 10^{-3}°), fo: output frequency	
Indicator (fluorescent display tube indication)				
Voltmeter (*13) (*15)	Resolution	RMS display mode	0.1 V	
		PEAK display mode	0.2 V (0 to 212 V)/0.3 V (211.5 to 424 V)/0.5 V (423.5 to 848 V)	
	Accuracy	RMS display mode	Within ± (1% of r.d.g + 2d) (from 10 to 610 V and at room temperature)	
		PEAK display mode	Within ± (2% of r.d.g + 2d) (from 10 to 848 V and at room temperature)	
Ammeter (*13) (*15)	Resolution	RMS display mode	0.01 A	0.1 A
		PEAK display mode	0.02 A	0.2 A
	Accuracy	RMS display mode	Within ± (1% of r.d.g + 2d) (from 5% of maximum rated current to maximum rated current, and at room temperature)	
		PEAK display mode	Within ± (2% of r.d.g + 4d) (from 5% of maximum rated current to maximum rated peak current, and at room temperature)	

Model name			PCR6000LT	PCR12000LT
Indicator (fluorescent display tube indication)				
	Wattmeter(*16)	Resolution	0.1 w/1 w	0.1 w/1 w/10 w
		Accuracy	Within ±(1% of r.d.g + 3d) (from 10% of rated power capacity to rated power capacity, at a load power-factor of 1.0, and at room temperature)	
	Frequency indicator (*4)	Resolution	0.01 Hz/0.1 Hz	
Insulation resistance	Input-to-cubicle, output-to-cubicle, and input-to-output		10 MΩ or more at 500 V DC	
Withstanding voltage	Input-to-cubicle, output-to-cubicle, and input-to-output		1.5 kV AC for one minute	
Power circuit			Linear amplifier	
Service ambient temperature humidity			0 to 40°C (32 to 104°F)/10 to 90% R.H. (no dew condensation allowed)	
Dimensions			See 11.3, Dimensions.	
Weight			Approx. 180 kg	Approx. 480 kg
I/O terminal board connection screws				
	Input terminal board		M6	M6
	Output terminal board		M6	M8
Accessories				
	Input power cables	Type	Single-core cable, four	Single-core cable, four
		Wire size (nominal conductor cross-section/length)	8 mm^2/5 m	38 mm^2/5 m
	Power connection cable		—	Twelve (14 mm^2, approx. 80 cm)
	Power supply connection cable		—	Two
	SIG cable		—	Two
	Duct	Duct base	—	Three
		Duct cover		One (U-phase power or supply) Two (V-, W-phase power supplies)
		Fixing screws		M4, 27 pcs
	Single-touch clamper		—	Twelve
	Cable clampers		One set Together with fixing screws (M3: 2 pcs, M4: 2 pcs)	One set Together with fixing screws (M3: 5 pcs, M4: 2 pcs)
	SIG cable clamper		—	Four sets Together with fixing screws (M3: 2 pcs) × 4
	Connecting parts	Joint holder	—	Eight
		Bolt		Sixteen
		Washer		Sixteen
		Collar		Sixteen
	Operation manual		One	
	Weight seal		One	Three

(*1) For 100 V/200 V output phase voltage, rated output current, load power factor of 1, and an output frequency of 40 to 999.9 Hz
(*2) The 100 V/200 V range can be selected using the switch on the front panel. Resolution: 0.1 V
(*3) For an output phase voltage of 1 to 100 V/2 to 200 V, and a load power factor of 0.8 to 1
When output phase voltage is 100 to 150 V/200 to 300 V, the output current is reduced by the output phase voltage. Fig. 1
When the load-power factor is 0 to 0.8, the output current is reduced by load power factor. Fig. 2
When the output frequency is 1 to 40 Hz, the output current is reduced by output frequency. Fig. 3
(*4) For near an output phase voltage peak (± 15 deg) (However, it is limited by rated output current rms value.)
(*5) Resolution: 1) 0.01 Hz (1.00 to 100.0 Hz) 2) 0.1 Hz (100.0 to 999.9 Hz)
(*6) For an output phase voltage of 80 to 150 V/160 to 300 V, and a load-power factor of 1. The value specified is obtained at the output terminal board.
(*7) For an output phase voltage of 80 to 150 V/160 to 300 V and a load-power factor of 1. The value specified is the output voltage variation obtained with 200 Hz as a reference.
(*8) For 100 V/200 V output phase voltage and 0 A output current
(*9) For an output voltage of 80 to 150 V/160 to 300 V and a load-power factor of 1
(*10) To change from the 0 A output current to the rated value and vice versa when output voltage is 100 V/200 V, and the load-power factor is 1.
(*11) A phase difference between output voltages (phase voltages) of each phase based on the neutral point, when it is not changed (120° between each phase).
(*12) Example that a specific frequency is substituted for the expression in the table.
Within 120° ± 0.5° (at 60 Hz output)
Within 120° ± 1.2° (at 400 Hz output)
(*13) For true rms value display or waveform with a crest factor of 3 or less
(*14) The output frequency set value (internal reference frequency) is indicated.
(*15) With a frequency from 40 to 999.9 Hz
(*16) With a frequency from 45 to 65 Hz

■ Output voltage percentage - rated output current characteristics

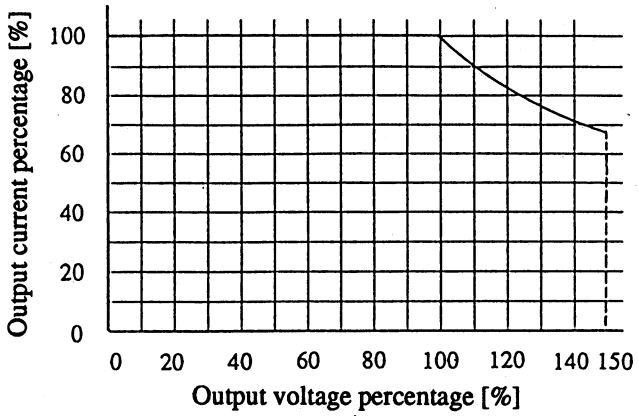


Fig.1

■ Load power factor - rated output current characteristics

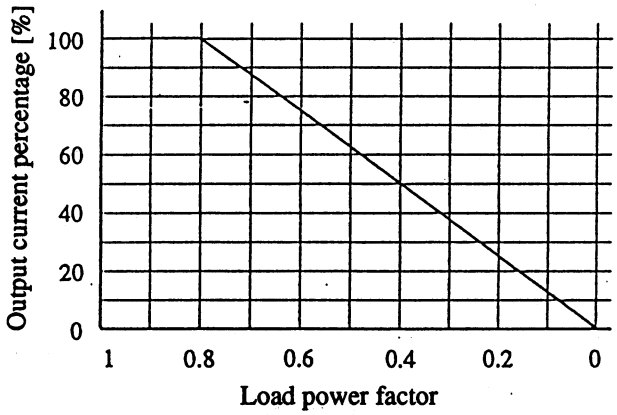


Fig.2

■ Output frequency - rated output current characteristics

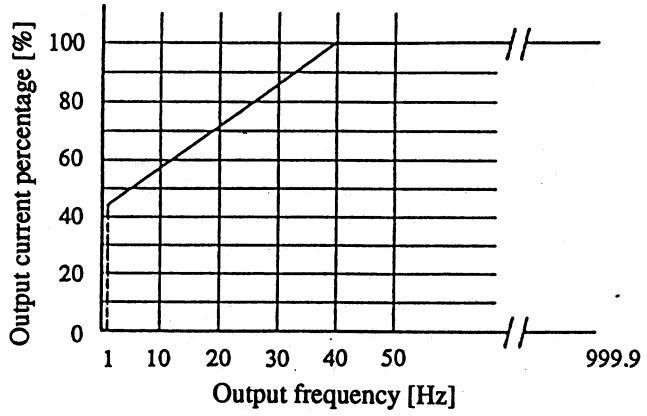


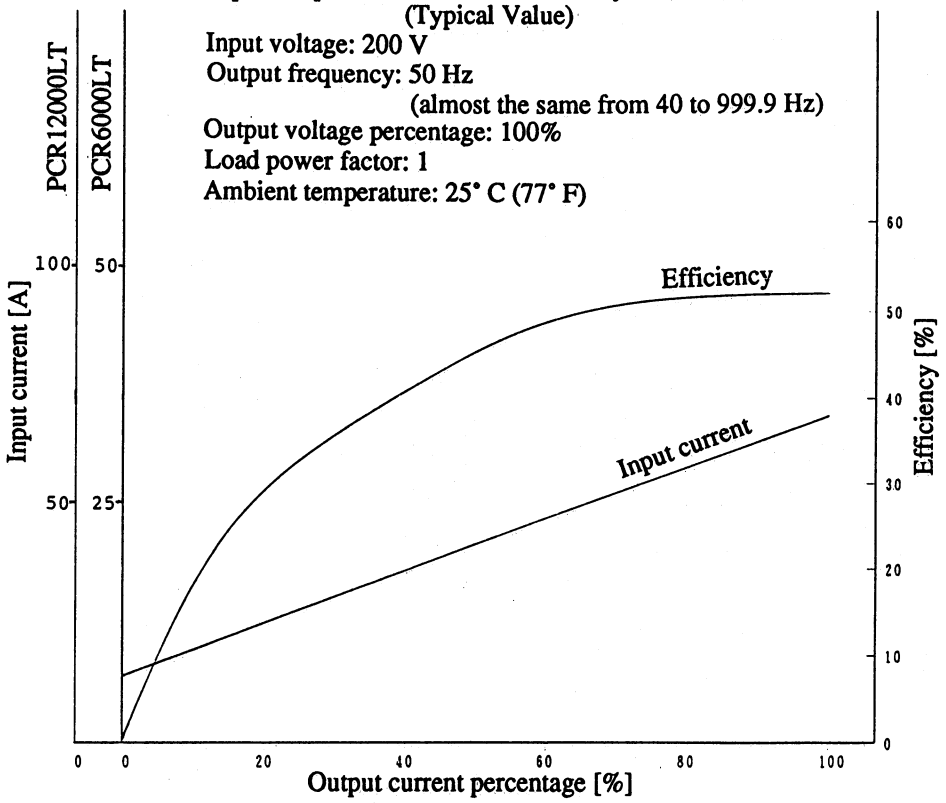
Fig.3

- The output voltage percentage is obtained when 100 V/200 V output voltage (in the 100 V/200 V output range) is treated as 100%.
- The output current percentage is obtained when the maximum rated output current is treated as 100%.
- Based on Figs. 1 and 2, the rated output current is the product of both output current percentages shown. Also, the output current percentage in Fig. 3 takes priority if the value obtained based on Fig. 3 is smaller than the product obtained from Figs. 1 and 2.

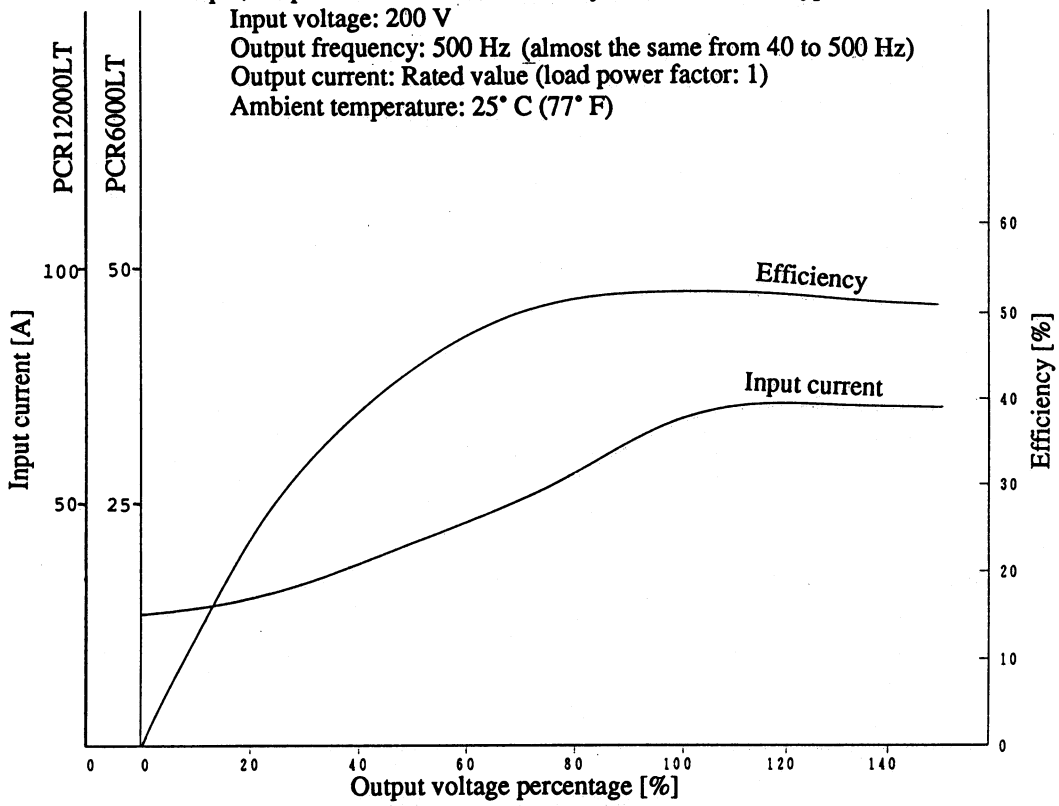
11.2 Operating Characteristics

- The output voltage percentage is obtained when 100 V/200 V output voltage (in 100 V/200 V output range) is treated as 100%.
- The output current percentage is obtained when the maximum rated output current is treated as 100%.

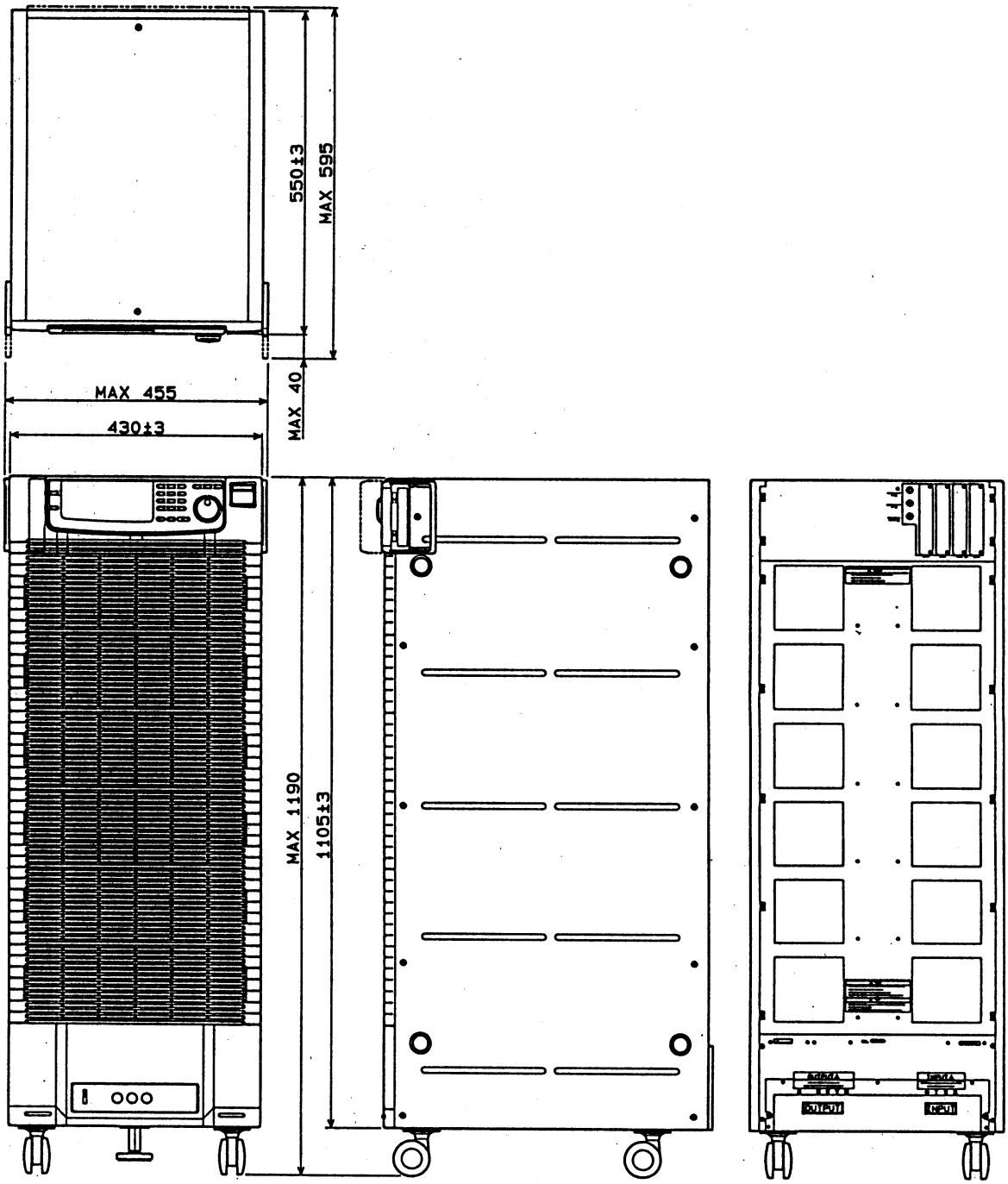
Input/Output Current Ratio; Efficiency Characteristics
(Typical Value)
Input voltage: 200 V
Output frequency: 50 Hz
(almost the same from 40 to 999.9 Hz)
Output voltage percentage: 100%
Load power factor: 1
Ambient temperature: 25° C (77° F)



Input/Output Current Ratio; Efficiency Characteristics (Typical Value)
Input voltage: 200 V
Output frequency: 500 Hz (almost the same from 40 to 500 Hz)
Output current: Rated value (load power factor: 1)
Ambient temperature: 25° C (77° F)



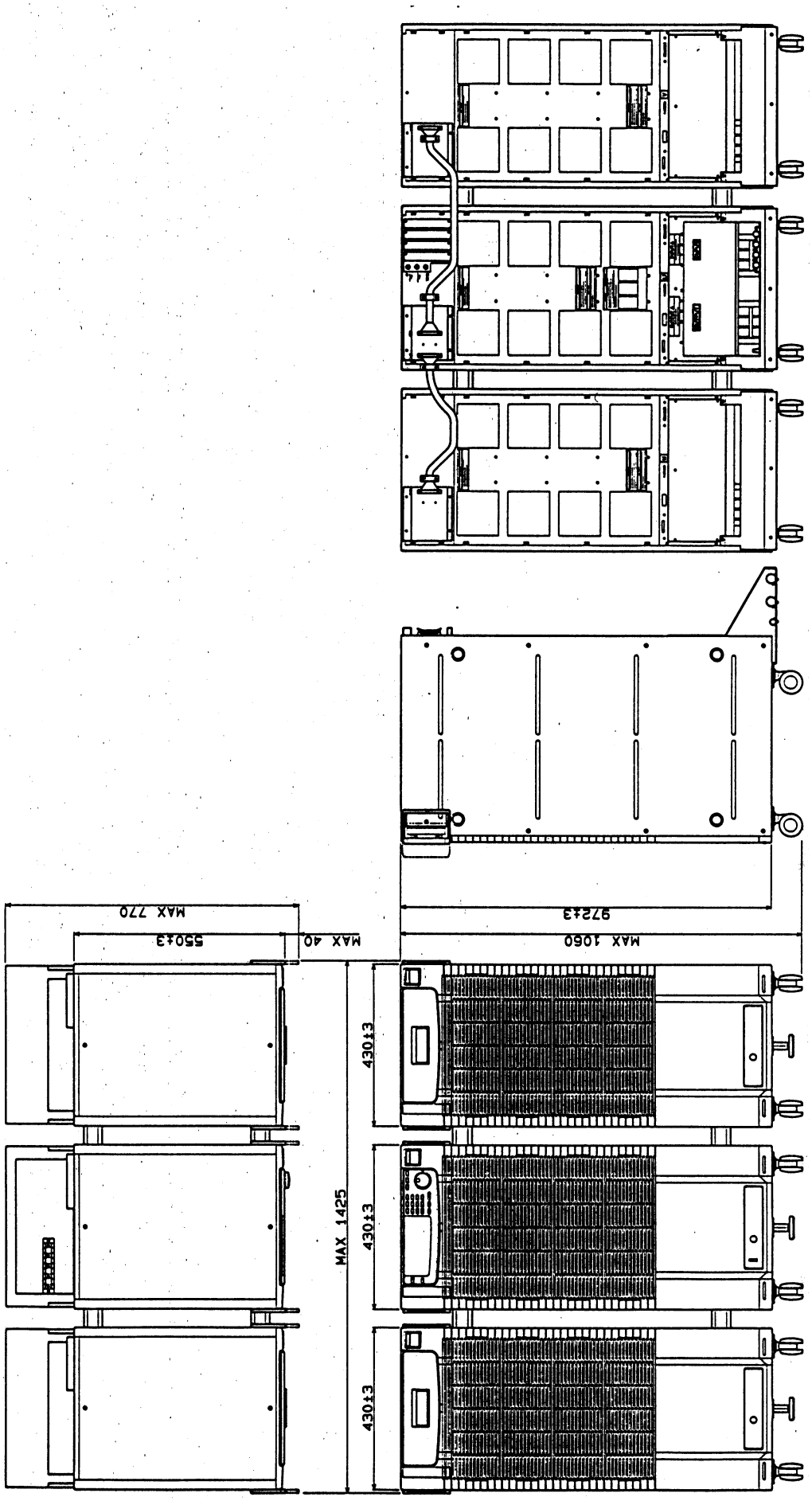
11.3 Dimensions



PCR6000LT

Unit: mm

Unit: mm

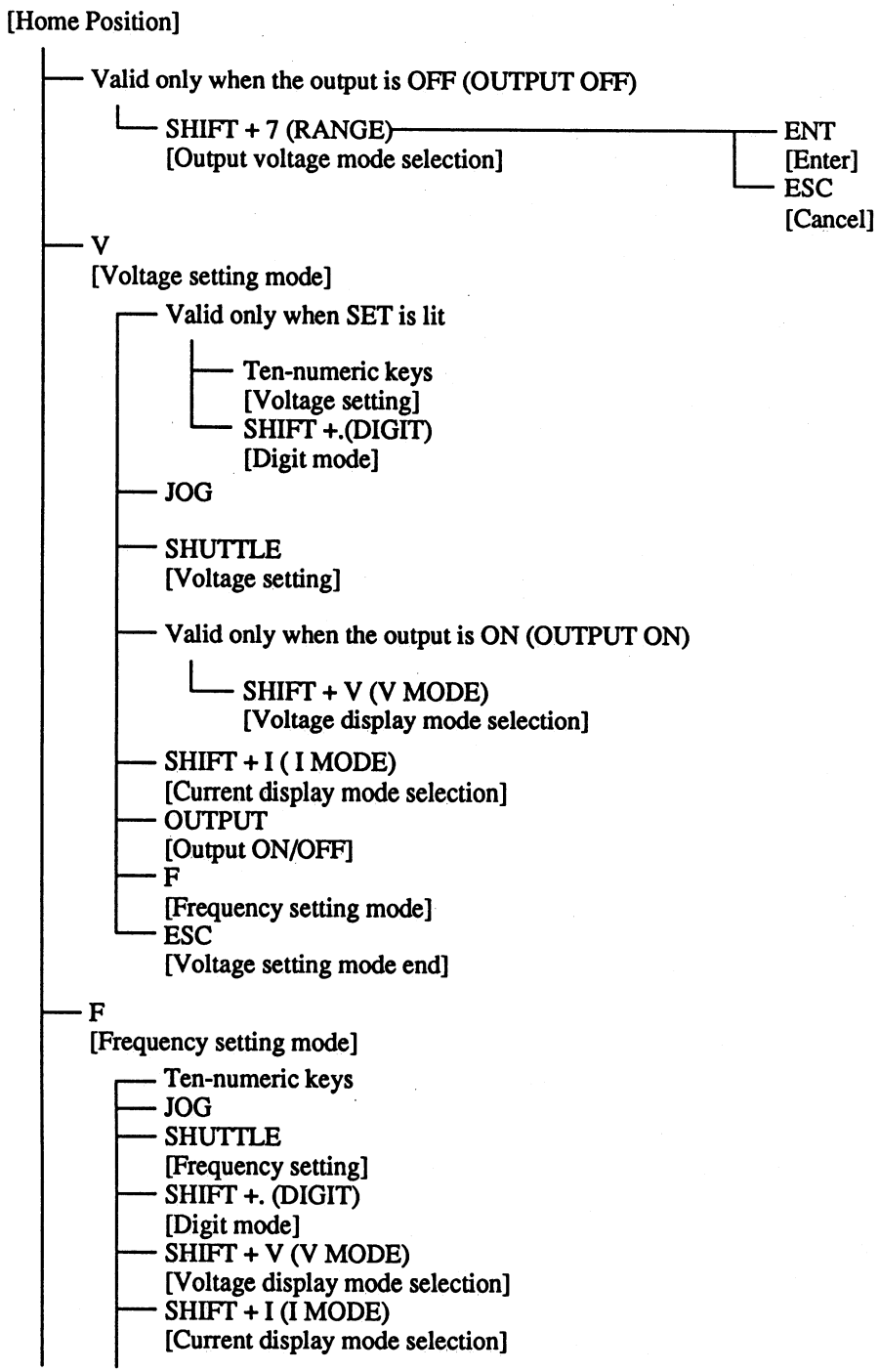


PCR12000LT

APPENDIX

Contents

Appendix 1 Control Panel Key Operating Menu Hierarchy

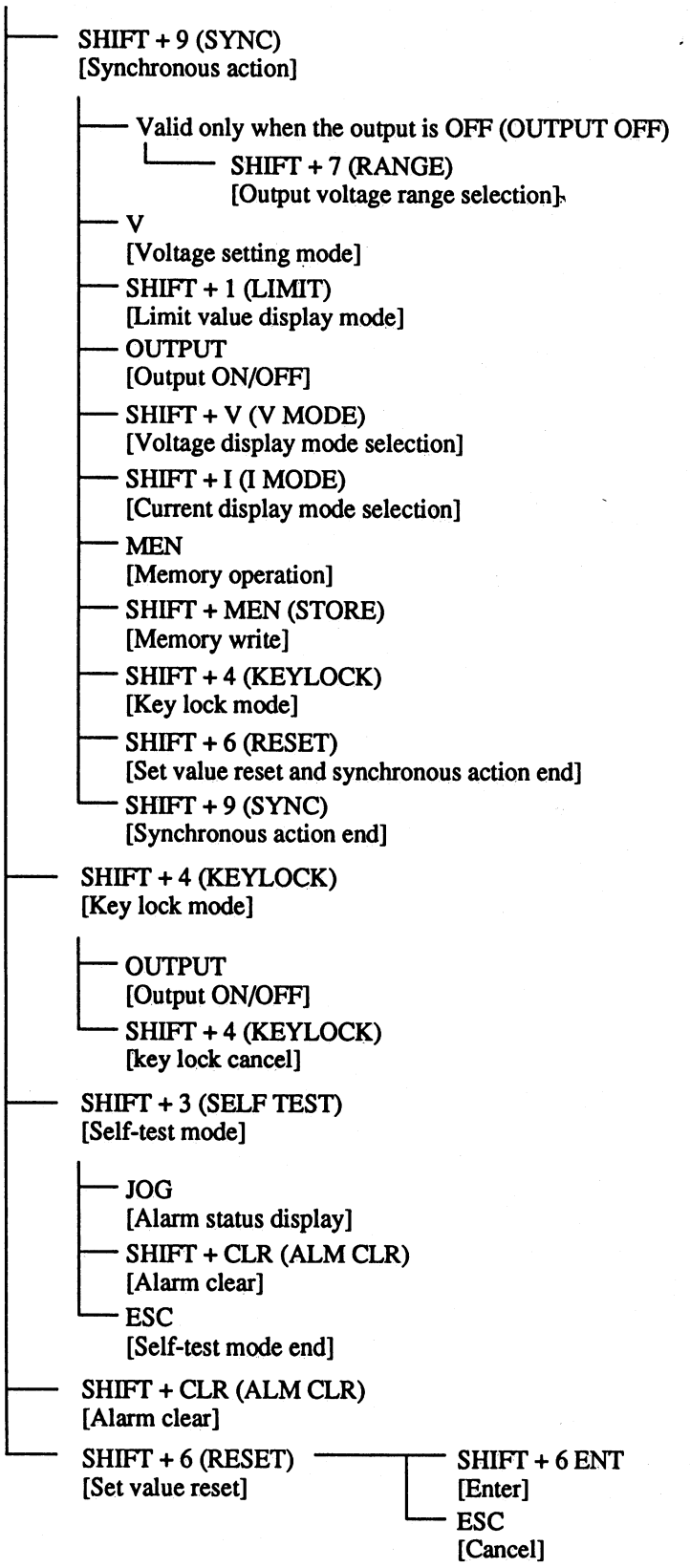


- OUTPUT
  [Output ON/OFF]
- V
  [Voltage setting mode]
- ESC
  [Frequency setting mode end]

- SHIFT + 1 (LIMIT)
  [Limit value display mode]
  - SHIFT + 1 (LIMIT)
    [Limit value display switching HIGH/LOW]
  - V
    [Voltage limit setting mode]
    - Ten-numeric keys
    - JOG
    - SHUTTLE
      [Voltage limit value setting]
    - F
      [Frequency limit setting mode]
    - Valid only when HIGH LIMIT is lit
      - I
        [Current limit setting mode]
    - SHIFT + 1 (LIMIT)
      [Limit value display switching HIGH/LOW]
    - OUTPUT
      [Output ON/OFF]
    - ESC
      [Voltage limit setting mode end]
  - F
    [Frequency limit setting mode]
    - Numeric keys
    - JOG
    - SHUTTLE
      [Frequency limit value setting]
    - V
      [Voltage limit setting mode]
    - Valid only when HIGH LIMIT is lit
      - I
        [Current limit setting mode]
    - SHIFT + 1 (LIMIT)
      [Limit value display switching (HIGH/LOW)]
    - OUTPUT
      [Output ON/OFF]
    - ESC
      [Frequency limit setting mode end]

- Valid only when HIGH LIMIT is lit
  - I
    [Current limit setting mode]
    - Numeric keys
    - JOG
    - SHUTTLE
      [Current limit value setting]
    - V
      [Voltage limit setting mode]
    - F
      [Frequency limit setting mode]
    - OUTPUT
      [Output ON/OFF]
    - ESC
      [Current limit setting mode end]
- OUTPUT
  [Output ON/OFF]
- ESC
  [Limit value display mode end]

- OUTPUT
  [Output ON/OFF]
- SHIFT + V (V MODE)
  [Voltage display mode selection] (Vset, V, Vrms, Vpeak)
- SHIFT + I (I MODE)
  [Current display mode selection] (A, Arms, Apeak, W)
- MEM
  [Memory operation]
  - 0 ~ 9
    [Memory address selection]
    - ENT
      [Enter]
    - ESC
      [Cancel]
  - JOG
    [Memory address selection]
    - ENT
      [Enter]
    - ESC
      [Cancel]
  - SHUTTLE
    [Memory address selection]
    - ENT
      [Enter]
    - ESC
      [Cancel]
  - OUTPUT
    [Output ON/OFF]
  - ESC
    [Memory operation end]
- SHIFT + MEM (STORE)
  [Memory write]
  - 1 ~ 9
    [Memory address selection]
    - ENT
      [Enter]
    - ESC
      [Cancel]
  - JOG
    [Memory address selection]
    - ENT
      [Enter]
    - ESC
      [Cancel]
  - SHUTTLE
    [Memory address selection]
    - ENT
      [Enter]
    - ESC
      [Cancel]
  - OUTPUT
    [Output ON/OFF]
  - ESC
    [Memory write end]


SHIFT + 9 (SYNC)
[Synchronous action]
Valid only when the output is OFF (OUTPUT OFF)
SHIFT + 7 (RANGE)
[Output voltage range selection]
V
[Voltage setting mode]
SHIFT + 1 (LIMIT)
[Limit value display mode]
OUTPUT
[Output ON/OFF]
SHIFT + V (V MODE)
[Voltage display mode selection]
SHIFT + I (I MODE)
[Current display mode selection]
MEN
[Memory operation]
SHIFT + MEN (STORE)
[Memory write]
SHIFT + 4 (KEYLOCK)
[Key lock mode]
SHIFT + 6 (RESET)
[Set value reset and synchronous action end]
SHIFT + 9 (SYNC)
[Synchronous action end]
SHIFT + 4 (KEYLOCK)
[Key lock mode]
OUTPUT
[Output ON/OFF]
SHIFT + 4 (KEYLOCK)
[key lock cancel]
SHIFT + 3 (SELF TEST)
[Self-test mode]
JOG
[Alarm status display]
SHIFT + CLR (ALM CLR)
[Alarm clear]
ESC
[Self-test mode end]
SHIFT + CLR (ALM CLR)
[Alarm clear]
SHIFT + 6 (RESET)
[Set value reset]
SHIFT + 6 ENT
[Enter]
ESC
[Cancel]

Appendix 2 Glossary

1. Rated Output (Power) Capacity or Power Capacity

Maximum Value (unit:VA) of output power capacity that can be continuously supplied in the following range.

Output voltage	For the 100 V output range	100 V to 150 V
	For the 200 V output range	200 V to 300 V
Load power factor		0.8 to 1.0
Output frequency		40 Hz to 999.9 Hz

- For example, PCR6000LT has a rated output capacity of 6 [kVA].

2. Maximum Rated Output Current

Maximum value (unit: A) of the output current (rms value) that can be continuously supplied in the following range.

Voltage in which the output voltage percentage is 100%	For the 100 V output range	100 V
	For the 200 V output range	200 V
Load power factor		0.8 to 1.0
Output frequency		40 Hz to 999.9 Hz

$$\text{Maximum rated output current} = \frac{\text{Rated output (power) capacity [VA]}}{\text{Voltage at which the output voltage percentage is 100\% [V]**}}$$

** 100 V or 200 V

3. Rated Output Current

Maximum continuous value of the output current (rms value) reduced by a combination of the output voltage, load power factor, and output frequency.

- For further details, see the description of "Output and Load of this Equipment" in Chapter 5.

4. Maximum Output Peak Current (Maximum Peak Current)

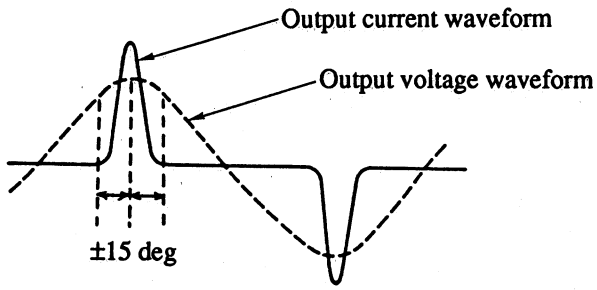
Maximum continuous value (unit: A peak) of the output current (peak value) that the equipment can supply to a capacitor-input rectifying load.

Maximum output peak current = Maximum rated output current (rms value) × 4

$$\text{Only when the crest value} = \frac{\text{peak value}}{\text{rms value}} \leqq 4$$

Output voltage 100 to 150 V (for the 100 V output range)
200 to 300 V (for the 200 V output range)
Output frequency 40 Hz to 99.9 Hz

[Sample output current waveform]



5. Instantaneous Peak Current

Maximum instantaneous (for about 1 second) value (unit: A peak) of the output current (peak value) that the equipment can supply to a load.
The instantaneous peak current differs from the current waveform, output voltage, output frequency, and load-power factor.

Example: When the sine wave output voltage is 100 V, the output frequency is 50 Hz, and the load power factor is 1
Instantaneous peak current (peak value) = Maximum rated output current (rms value) × 2

- For further details, see the description of "Output and Load of this Equipment" in Chapter 5.

6. Instantaneous Peak Current Percentage

Percentage (%) of instantaneous peak current when the maximum rated output current is regarded as 100%.

- For further details, see the description of "Output and Load of this Equipment" in Chapter 5.

7. Output Current Percentage

Percentage (%) of the output current when the maximum rated output current is regarded as 100%.

8. Output Voltage Percentage

Percentage (%) of the output voltage when an output voltage of 100 V/200 V is regarded as 100% in the 100 V/200 V output range.

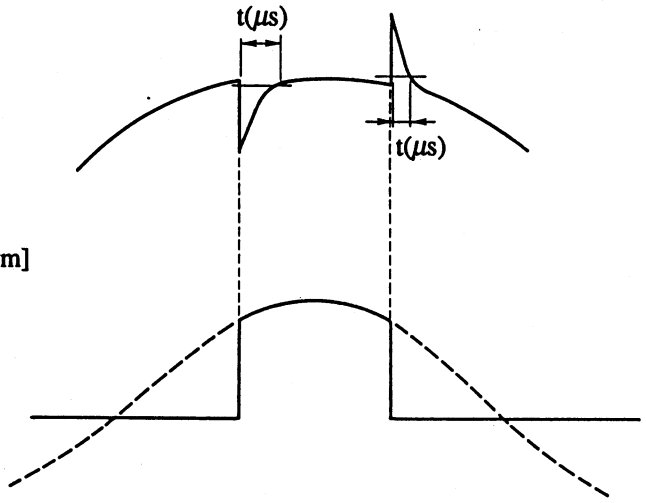
9. Output Voltage Waveform Distortion Factor

Total harmonic distortion Factor (%) of the output voltage waveform when the output voltage is 80 to 150 V (for the 100 V output range) or 160 to 300 V (for the 200 V output range), and the load power factor is 1.

10. Output Voltage Response Time

Time (unit: ms) from the instant the output voltage change exceeds 10% of the overall change to the instant the output voltage change returns to within 10% of the overall change, while the output current percentage changes from 0% to 100% when the output voltage is 100 V (for 100 V output range) or 200 V (for the 200 V output range) and the load power factor is 1.

[Output voltage waveform]



[Output current waveform]

11. Active Filter

A circuit used to reduce the input current distortion factor (harmonic current). This filter is used in the input power supply block of the equipment. It is a switching-control active filter. Using an active filter improves the power factor (0.95 or more, and the current waveform is virtually sinusoidal), and the input voltage is less distorted.

12. Three-phase Capacitor-Input-Type Rectifying (Circuit) Load

The "three-phase capacitor-input-type rectifying load" has a filter capacitor connected directly across the rectifier output, as shown in Fig. A. This type of load draws a current as shown in Fig. B.
In this case, the input current peak value is generally two to four times the rms value, causing a conduction angle (duration for which current flows) of 20 to 90 degrees, centering at an output voltage phase-angle of 60, 120, 240, and 300 degrees. The equipment is capable of supplying a peak current about two times the maximum current (rms value) around an output phase voltage phase-angle of 60, 120, 240, and 300 degrees.
(However, peak current is limited based on rated output current rms value.)

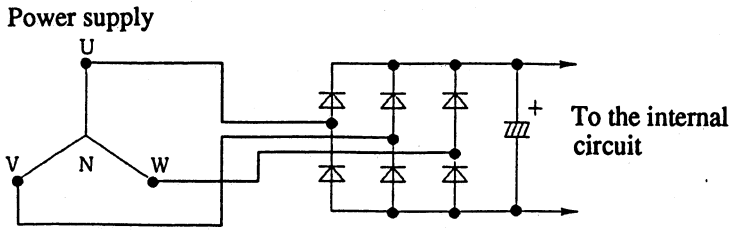


Fig.A

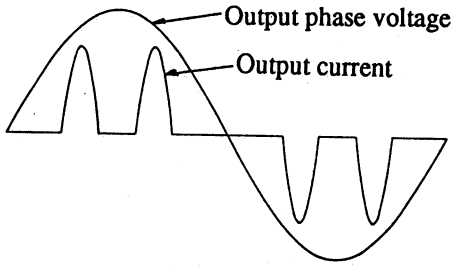


Fig.B

- Typical examples of three-phase capacitor-input-type rectifying loads

Consumer electronics appliances:	Inverter air conditioners
Office automation equipment:	Office computers, and CAD systems
Others:	Mainframe computers, factory automation equipment, communication equipment, and other switching power supply equipped devices and equipment.

13. Derating

This generally means reducing the claimed maximum performance ratings (such as voltage and current) of the relevant equipment or devices with respect to ambient conditions (such as temperature and load).

14. Instantaneous Voltage Drop

This is known as the status in which the voltage in a commercial power line instantaneously drops due to the effects of lighting.
Generally, in such cases the voltage drop time is several dozen msec to hundreds of msec, and the voltage drop level is 20 to 80%.

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