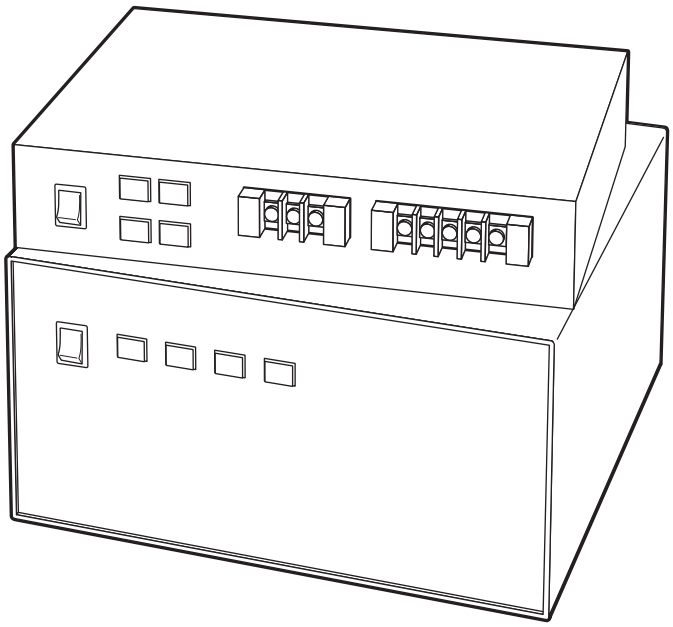
Part No. Z1-002-762, IB004062
Nov. 2006

OPERATION MANUAL

OUTPUT EXPANSION KIT
PCR-LA Series

OT01-PCR6000LA/3
OT01-PCR12000LA/3
OT01-PCR18000LA/3



KIKUSUI

Use of Operation Manual

Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

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

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

⚠ Safety Symbols

For the safe use and safe maintenance of this product, the following symbols are used throughout this manual and on the product. Understand the meanings of the symbols and observe the instructions they indicate (the choice of symbols used depends on the products).

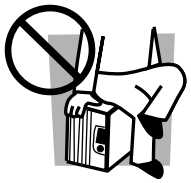
	Indicates that a high voltage (over 1000 V) is used here. Touching the part causes a possibly fatal electric shock. If physical contact is required by your work, start work only after you make sure that no voltage is output here.
DANGER	Indicates an imminently hazardous situation which, if ignored, will result in death or serious injury.
⚠ WARNING	Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if ignored, may result in damage to the product and other property.
	Shows that the act indicated is prohibited.
	Is placed before the sign “DANGER,” “WARNING,” or “CAUTION” to emphasize these. When this symbol is marked on the product, see the relevant sections in this manual.
	Indicates a protective conductor terminal.
	Indicates a chassis (frame) terminal.

⚠ Safety Precautions

The following are safety precautions to be observed in order to avoid fire hazard, electric shock, accidents, and other failures. It is not possible to predict all potential hazards; however, the following describes all known possible hazardous conditions. Keep them in mind and make sure that all of them are observed properly.

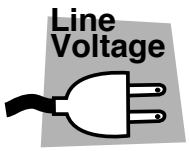
Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If it is handled by disqualified personnel, personal injury may result. Be sure to handle it under supervision of qualified personnel (those who have electrical knowledge.)
- This product is not designed or manufactured for general home or consumer use.



Purposes of use

- Do not use the product for purposes other than those described in the operation manual.

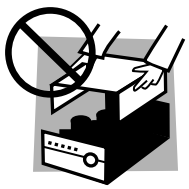


Input power

- Use the product with the specified input power voltage.
- For applying power, use the power cable provided. Note that the provided power cable is not use with some products that can switch among different input power voltages or use 100 V and 200 V without switching between them. In such a case, use an appropriate power cable.

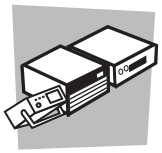
Fuse

- With products with a fuse holder on the exterior surface, the fuse can be replaced with a new one. When replacing a fuse, use the one which has appropriate shape, ratings, and specifications.



Cover

- There are parts inside the product which may cause physical hazards. Do not remove the external cover.



Installation

- When installing products be sure to observe “2.2 Precautions on Installation” described in this manual.
- To avoid electrical shock, connect the protective ground terminal to electrical ground (safety ground).
- When connecting the power cable to a switchboard, be sure work is performed by a qualified and licensed electrician or is conducted under the direction of such a person.
- When installing products with casters, be sure to lock the casters.

Relocation

- Turn off the power switch and then disconnect all cables when relocating the product.
- Use two or more persons when relocating the product which weights more than 20 kg. The weight of the products can be found on the rear panel of the product and/or in this operation manual.
- Use extra precautions such as using more people when relocating into or out of present locations including inclines or steps. Also handle carefully when relocating tall products as they can fall over easily.
- Be sure the operation manual be included when the product is relocated.

Operation

- Check that the AC input voltage setting and the fuse rating are satisfied and that there is no abnormality on the surface of the power cable. Be sure to unplug the power cable or stop applying power before checking.
- If any abnormality or failure is detected in the products, stop using it immediately. Unplug the power cable or disconnect the power cable from the switchboard. Be careful not to allow the product to be used before it is completely repaired.
- For output wiring or load cables, use connection cables with larger current capacity.
- Do not disassemble or modify the product. If it must be modified, contact Kikusui distributor/agent.

Maintenance and checking

- To avoid electrical shock, be absolutely sure to unplug the power cable or stop applying power before performing maintenance or checking.
- Do not remove the cover when performing maintenance or checking.
- To maintain performance and safe operation of the product, it is recommended that periodic maintenance, checking, cleaning, and calibration be performed.

Service

- Internal service is to be done by Kikusui service engineers. If the product must be adjusted or repaired, contact Kikusui distributor/agent.

Arrangement of this manual

This Operation Manual is made up of the following sections.

Chapter 1 General

Provides an overview and describes the features of the Single-phase/Three-phase Output Expansion Kits.

Chapter 2 Installation and Preparation for Use

Describes the procedures necessary for unpacking the product for preparation prior to use.

Chapter 3 Output Switching (Operation of the Output Terminal)

Describes output-switching operations of the Output Terminal configured as a single phase/three-phase switching system.

Chapter 4 Part Names and Functions (Output Terminal)

Denotes the names of switches, displays, terminals, and other parts on the front and rear panels of the Output Terminal. Also describes their functions.

Chapter 5 Single-phase Parallel Operation (Operations of PCR-LA AC Power Supplies)

Describes the procedure for operation of the PCR-LA power supplies in single-phase parallel operation. For the method of operating a PCR-LA power supply singly, see the PCR-LA AC Power Supply Operation Manual.

Chapter 6 Three-phase Operation (Operations of PCR-LA AC Power Supplies)

Describes the procedure for operation of the PCR-LA power supplies in three-phase operation. For the method for operating a PCR-LA power supply singly, see the PCR-LA AC Power Supply Operation Manual.

Chapter 7 Maintenance

Describes the maintenance procedure for the system, including the PCR-LA AC power supplies. Also explains the remedies against possible malfunctions encountered during use of the system.

Chapter 8 Specifications

Shows the specifications and accessories for the Output Expansion Kits.

Contents

Chapter 1 General

Provides an overview and describes the features of the Single-phase/Three-phase Output Expansion Kits.

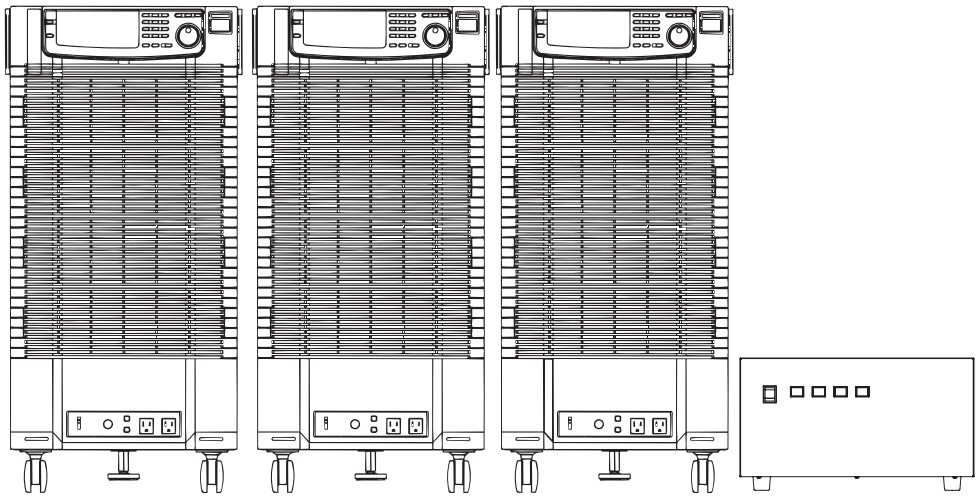
1.1 Outline of the Product

These products are Output Expansion Kits for the PCR-LA series AC power supplies. An output expansion kit enables configuration of a system capable of switching the outputs of multiple PCR-LA power supplies to obtain single- or three-phase outputs. Output switching is performed at the Output Terminal section. The customer should make connections between the respective units. All of the cables required for connections are provided with the Output Expansion Kits.

A system is configured on the basis of the PCR-LA series single-phase output power supplies. In single-phase parallel operations, three power supplies are operated in parallel. In three-phase operations, three power supplies generate outputs in respective phases.

■ List of the Output Expansion Kits

Model name	Number of PCR-LA power supplies	Rated output capacity
OT01-PCR6000LA/3	Three PCR2000LAs	6 kVA
OT01-PCR12000LA/3	Three PCR4000LAs	12 kVA
OT01-PCR18000LA/3	Three PCR6000LAs	18 kVA



Three PCR4000LAs

Output Terminal section

Fig. 1-1 Example of the Configuration of a Single-phase/Three-phase Switching System, OT01-PCR12000LA/3

1.2 Features

■ Single-phase/three-phase switching system

Single-phase/three-phase switching can be achieved without modifying cable connections. The Output Terminal has dedicated output terminals for single-phase and three-phase, respectively, which is convenient for connecting and disconnecting a load.

■ Single-phase parallel operation

Control

A system of AC power supplies capable of generating high-quality, large-capacity output can be realized. The three PCR-LA power supplies are operated in parallel, two slaves of which are controlled by the master unit.

■ Three-phase operation

Control

For three-phase outputs, three AC power supplies are assigned to the U-, V-, and W-phases, respectively. The U-phase unit controls the other two-phase units.

Phase voltage unbalance

Generally, all phase voltages are set in one operation, but it is also possible to set phase voltages on a phase basis.

Line voltage measurements

The system is capable of measuring not only phase voltages but also line voltages.

Three-phase power

The power and apparent power of a load can be displayed as the total value of those measured by the three PCR-LA power supplies. The total power factor for the three phases is also calculated from the total of measured values. (Note that the measurement of apparent power or the power factor requires the RS-232C Control, the optional RC04-PCR-LA, or the optional IB03-PCR-LA.)*1

Phase setting

There is generally a phase difference of 120° between phases in three-phase output. This phase difference can be set flexibly. (Note that this function requires the RS-232C Control, the optional RC04-PCR-LA, or the optional IB03-PCR-LA.)*1

*1 RC04-PCR-LA: Remote Controller
IB03-PCR-LA: GPIB Interface

1.3 Outline of the Operating Sections

The operating sections are the front panel of the Output Terminal and the PCR-LA AC power supply's control panel.

■ Output Terminal's front panel operating section

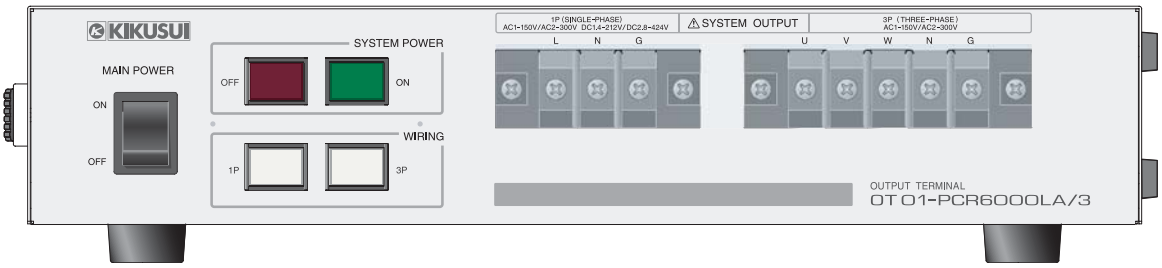


Fig. 1-2 OT01-PCR6000LA/3

Fig. 1-3 OT01-PCR12000LA/3 or OT01-PCR18000LA/3

■ PCR-LA power supply's control panel operating section

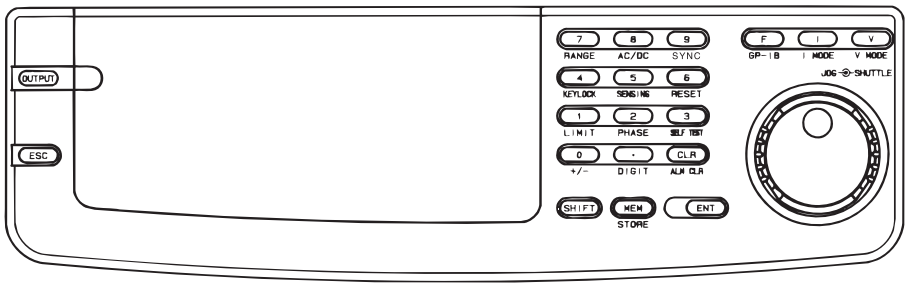


Fig. 1-4 PCR-LA Power Supply's Control Panel

1.4 Operation Manual and ROM Version

This Operation Manual applies to cases in which the expansion kit is connected to PCR-LA AC power supplies with ROM of

version 3.00 or later.

When making an inquiry about the product, please provide us with the following information:

- Model name of the PCR-LA power supplies
- ROM version of the PCR-LA power supplies
- Serial numbers and revision numbers of the PCR-LA power supplies (indicated at the lower rear of the products)

- Model name of this expansion kit
- Serial number and revision number of the expansion kit (indicated at the rear of the Output Terminal)

For the method of checking the ROM version, see the PCR-LA AC Power Supply Operation Manual.

1.5 Combination of Options

The table below shows a combination of the options available. They can be installed in the PCR-LA AC power supply in which the U-phase card has been installed.

Option name	Model name
Remote Controller	RC04-PCR-LA
GPIB Interface	IB03-PCR-LA

2

Chapter 2 Installation and Preparation for Use

Describes the procedures necessary for unpacking the product for preparation prior to use.

2.1 Check at Unpacking

Upon receiving the product, confirm that the package contains the necessary accessories and has not been damaged during transportation.

If the output expansion kit is damaged or any accessory is missing, notify Kikusui distributor/agent.

NOTE

- We recommend that all packing materials be saved, in case the product needs to be transported at a later date.

■ Power connection cables

Model name	Description
OT01-PCR6000LA/3	5.5 mm^2/2.5 m, 9 pcs. [91-80-7377 (three pcs.)x3]
OT01-PCR12000LA/3	14 mm^2/2.5 m, 9 pcs. [91-80-7524 (three pcs.)x3]
OT01-PCR18000LA/3	

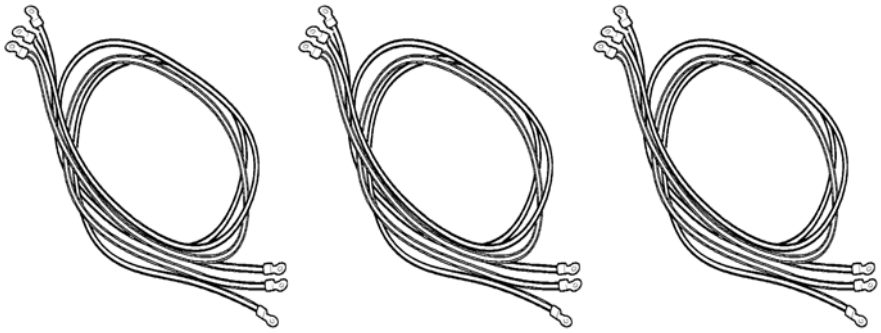
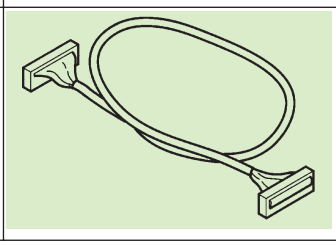


Fig. 2-1 Power Connection Cables, Nine

■ Signal connection cables

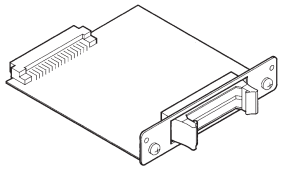
Part name	Description	
Signal connection cable 1 For OT01-PCR6000LA/3 [91-87-8154]	For master J1 (4 poles – 4 poles), one	

Part name	Description	
Signal connection cable 1 For OT01-PCR12000LA/3 For OT01-PCR18000LA/3 [91-87-8155]	For master J1 (4 poles – 6 poles), one	
Signal connection cable 2 (Common to each model) [91-87-8156]	For J4 (6 poles – 6 poles), three	
Signal connection cable 3 For OT01-PCR6000LA/3 [91-80-6900]	For J3 to J1 (4 poles – 4 poles), two	
Signal connection cable 3 For OT01-PCR12000LA/3 For OT01-PCR18000LA/3 [91-80-6901]	For J3 to J1 (6 poles – 6 poles), two	
Signal connection cable 4 (Common to each model) [91-87-8157]	For sensing (10 poles – 6 crimp terminals), one	
Signal connection cable 5 (Common to each model) [91-88-4453]	For the parallel-operation master With connectors at both ends (26 poles; length: 2.5 m), one	

■ Parallel Operation Driver: (common to each model) *1

Part name	Description
Master-unit card PD03M-OT01-PCR-LA	1
Slave-unit card PD03S-OT01-PCR-LA	2
Drive-signal cable	With drive-signal connectors (26 poles), two pcs.
Mounting screw (M3)	6

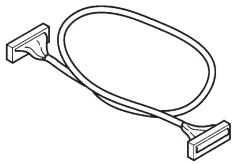
*1 These boards are dedicated for the expansion kits and are used when the PCR-LA AC power supplies are used in combination with the Output Terminal. They cannot be used for parallel or three-phase operations of PCR-LA power supplies only.



☐ Master-unit card (one board)/slave-unit cards (two boards) (total: three boards)

M3x6

☐ Card-mounting screws (two pcs. for each card, total of 6 pcs.) [M3-101-001]



☐ Drive-signal cable (26 poles; two pcs.; length: 0.7 m) [91-87-6330]

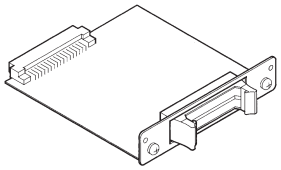
Fig. 2-2 Complete Set of Parallel Operation Drivers

■ 3-phase Output Driver: 3P03-OT01-PCR-LA (common to each model) *1

Part name	Description
U-phase card *2	1
V-phase card *2	1
W-phase card *2	1
Drive-signal cable	With drive-signal connectors (34 poles), two pcs.
Mounting screw (M3)	6

*1 These boards are dedicated for the expansion kits and are used when the PCR-LA AC power supplies are used in combination with the Output Terminal. They cannot be used for parallel or three-phase operations of PCR-LA power supplies only.

*2 The U-, V-, and W-phase cards have the indications “U,” “V,” and “W” on the panel part of each card.

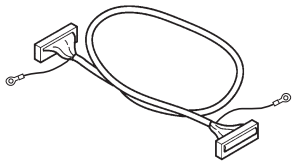


The U-, V-, and W-phase cards have the indications “U, ” “V, ” and “W” on the panel part of each card.

☐ U-, V-, and W-phase cards (one each, total of three cards)

M3x6

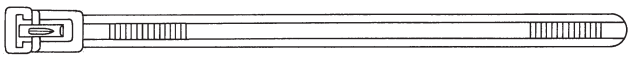
☐ Card-mounting screws (two pcs. for each card, total of 6 pcs.)
[M3-101-001]



☐ Drive-signal cable (34 poles, two pcs., length: 0.7 m)
[91-88-4452]

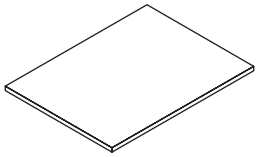
Fig. 2-3 Complete Set of 3-phase Output Drivers

■ Plastic tie for signal connection cables and Operation Manual (common to each model)

☐ 

[P4-200-001]

Fig. 2-4 Plastic Tie for Signal Connection Cables, one pc.



☐ Operation Manual, one copy
[Z1-002-762]

Fig. 2-5 Operation Manual (This Manual)

2.2 Precautions on Installation

Be sure to observe the following precautions when installing the product.

■ Do not use the product in a flammable atmosphere.

To prevent explosion or fire, do not use the product near combustible materials such as alcohol or thinner, or in an atmosphere containing such vapors.

■ Avoid locations subject to high temperatures or exposed to direct sunlight.

Do not locate the product near a heater or in areas subject to drastic temperature fluctuations.

Operating temperature range: 0 °C to 40 °C

■ Avoid humid locations.

Do not locate the product in a high-humidity location such as near a boiler, humidifier, or water supply.

Operating humidity range: 20 % to 80 % RH (no condensation allowed)

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

Condensation may occur even within the operating humidity range. In such a case, do not start using the product until it is completely dry.

■ Do not install the product in a corrosive atmosphere.

Do not install the product in a corrosive atmosphere or one containing sulfuric-acid mist or the like, as doing so may cause corrosion of conductors or improper connector contacts in the product, resulting in a malfunction or failure that could potentially lead to a fire.

However, modification may allow the product to cope with such an atmosphere. If the product is to be used in such an atmosphere, consult Kikusui distributor/agent.

■ Do not locate the product in a dusty environment.

Dirt and dust in the product may result in electric shock or fire.

■ Do not place any object on the Output Terminal.

Heavy objects, in particular, placed on the product could lead to a malfunction.

■ Do not install the product on a tilted surface or in a location subject to vibration.

The product may fall, resulting in damage or injury.

■ Do not use the product in locations affected by strong magnetic or electric fields, or where it will be exposed to waveform distortion or noise in the input power.

Placing the product in such a location may result in a malfunction.

■ Do not use the product in locations where there is a sensitive measuring instrument or receiver.

■ Handling of the driver cards

Always observe the following precautions when handling the driver card, as its PCB is not protected. Otherwise, a problem may occur.

Never touch any of the electronic parts installed in the PCB.

Never handle the driver cards under conditions in which static electricity may accumulate.

After unpacking the product carton, promptly install the driver cards in the PCR-LA power supplies.

When storing the driver cards, always take anti-electrostatic measures such as storing them in the bag in which they were packaged.

Do not drop the driver cards or subject them to other impact.

Do not place the driver cards where they could be exposed to water or other liquid.

■ Handling of the drive-signal cables

Never damage the cables.

Do not pull, bend, or apply any other stress to the cables.

2.3 Moving Precautions

When moving or transporting the product to an instillation site, observe the following precautions.

■ Turn OFF the Output Terminal's MAIN POWER switch and the PCR-LA AC power supplies' POWER switches.

Moving the Output Terminal or an AC power supply with the MAIN POWER or POWER switch turned ON may result in an electric shock or breakage.

■ Disconnect all wiring connected.

Moving the Output Terminal or an AC power supply with cables connected may cause a break in the cables or cause the respective units to fall, resulting in physical injury.

2.4 Grounding

The Output Terminal can be grounded by the following two methods. One of or both of the methods can be employed to ground the Output Terminal. However, we recommend the method in which power connection cables are employed.

1. Use the supplied power connection cables to connect the Output Terminal to the PCR-LA AC power supplies. This enables grounding to be provided for the Output Terminal. For the cable connection method, "2.5.2 Power Connection Cables".

   Connecting a power connection cable to the terminals marked "G" provides grounding for the Output Terminal.

2. Connect the protective conductor terminal ⏚ of the Output Terminal to an electrical ground (safety ground) directly.

⚠WARNING
- Failure to ground the Output Terminal may cause electric shock.
- There is a possibility of physical injury or death. Be sure to provide grounding.
- Connect the ground terminal to an electrical ground (safety ground).

For grounding of the PCR-LA AC power supplies, see the PCR-LA AC Power Supply Operation Manual.

2.5 Connections for a Single-phase/ Three-phase Switching System

Connecting cables between the Output Terminal and the three PCR-LA AC power supplies completes the system connections. The main cabling work consists of the following five items:

1. PCR-LA power supplies' input power
2. Power connection cables (to the outputs of the PCR-LA power supplies)
3. Signal connection cables
4. Parallel Operation Driver
5. 3-phase Output Driver

Always use the cables provided with the expansion kit.

NOTE
- The Output Terminal has no input power cables. Completing the system connections allows power to be supplied to the Output Terminal.

2.5.1 Input Power of PCR-LA Power Supplies (Three Units)

⚠ WARNING

- The PCR2000LA, PCR4000LA, and PCR6000LA are permanently installed AC power supplies. Be sure to connect these power supplies to the switchboard.
- There is a possibility of electric shock, which could result in injury or death. To prevent electric shock, turn OFF the switch on the switchboard (to cut off the power feed from the switchboard) and then connect the input power cables.
- Connection of the input power cables to the switchboard must be carried out by a qualified personnel.
- Install the input power cable such that the distance between the PCR-LA power supply and the switch on the switchboard is within 3 m. This procedure facilitates operation of the switch on the switchboard in the event of emergency.

  If the distance to the switch on the switchboard is to be 3 m or more, install the input power cables with a separate switch provided within 3 m from the Output Terminal. For such a switch, employ one of two poles that allows both the L and N poles to be simultaneously disconnected.

Be sure to match the polarity of the input terminals with that of the switchboard (L, N, and (GND)), and connect the cables securely. If the polarity (L, N, and ⏚) of the switchboard is unknown, always have it inspected by a qualified personnel or chief electrical technician.

If the input power cables provided cannot be used due to conditions at the installation site or for any other reason, please consult with a qualified personnel or chief electrical technician, and select the wire size (nominal conductor cross section) of the cable to be used in accordance with the indoor wiring regulations.

Connecting the input power cables

1. Remove the terminal-box cover from the rear of an AC power supply, and connect the provided input power cable(s) to the INPUT terminal board as shown in Fig. 2-6.
2. Turn off the switch on the switchboard.
3. Connect the input power cable(s) to the switchboard.

   The switchboard ends of the input power cable(s) provided do not have terminals. For termination, attach a crimp terminal to each wire (cable) that meets the terminal screws of the switchboard to be connected, then securely connect the wires (cables) to the terminal screws (connection must be carried out by a qualified personnel).
4. Set the INPUT VOLTAGE SELECTOR to 170 V AC-250 V AC.

   This system is designed especially for 200-V AC input. This step is not necessary for the PCR6000LA, as it is a power supply designed exclusively for 200-V AC input.

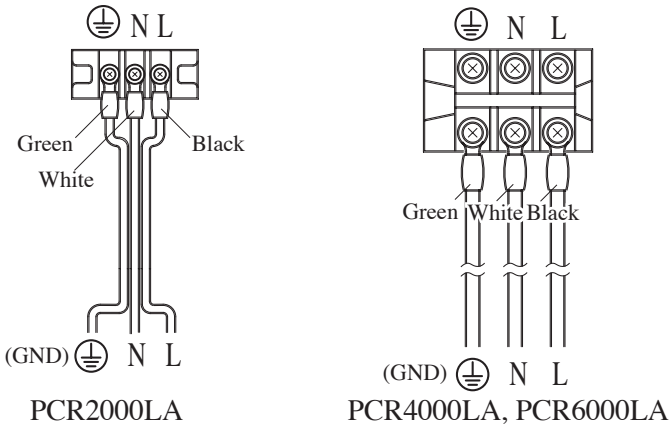
5. Install the cable clamper provided, and fix the input power cable(s) securely (Fig. 2-7).

   Using the provided M4 screws, attach part (A) to the power supply.

   In this case, place the wires of the provided input power cable or the provided input cables in the groove(s) of part (A).

   Using the provided M3 screws, install parts (B) and (C) to fix the individual wires or the cables.

6. Put the cover removed in step 1 back on.



PCR2000LA PCR4000LA, PCR6000LA

Fig. 2-6 Connecting the Input Power Cable(s) to the INPUT Terminal Board

Cable Clampers

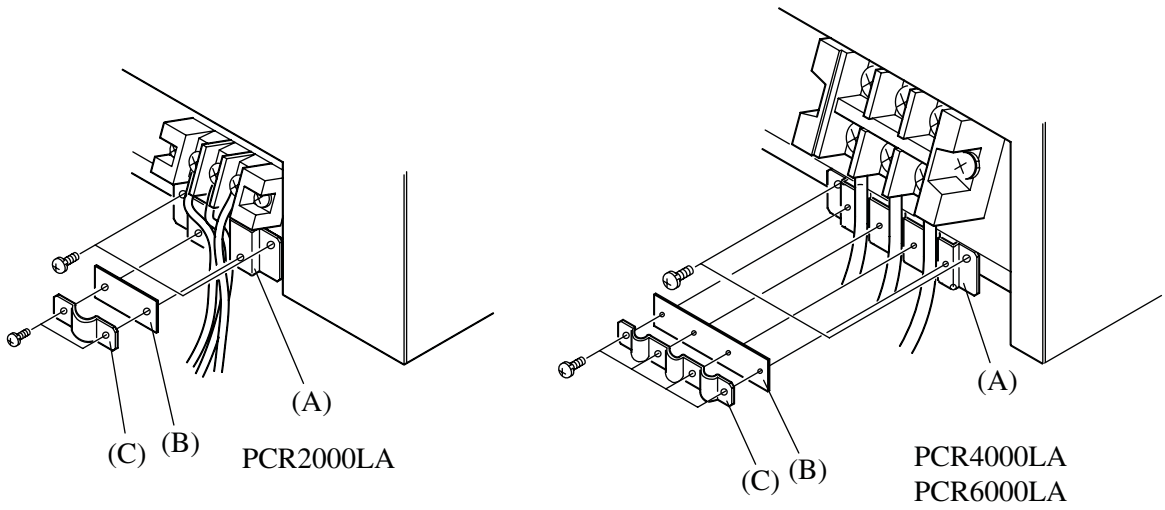


Fig. 2-7 Installing a Cable Clamper

- For crimp terminals to be installed on the PCR-LA power supply side, always use those matching the size of the terminal screws for the PCR-LA power supply's INPUT terminal board.
- For the wire sizes of the cables to be used, see the instructions in the PCR-LA AC Power Supply Operation Manual.

⚠CAUTION
- Improper tightening of a terminal screw may cause cable disconnection or an overheated connection, resulting in danger.
- Never attempt to connect the input power cable(s) to the OUTPUT terminal board of a PCR-LA power supply. Otherwise, a breakdown may result.

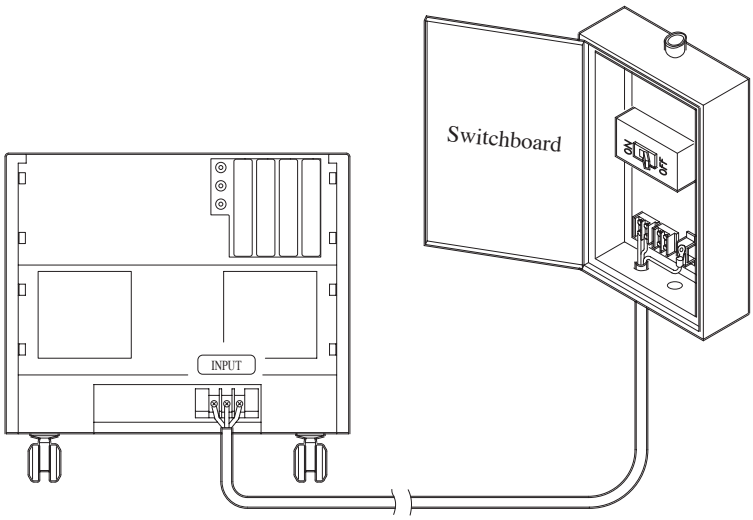


Fig. 2-8 Input Power Cable (on the Switchboard Side)

For the PCR2000LA, PCR4000LA, and PCR6000LA, connect the input power cable(s) securely so that the symbols "L," "N," and ⏚ (GND) on an output terminal board of the switchboard correspond to those symbols on the INPUT terminal board of an AC power supply.

INPUT VOLTAGE SELECTOR

For the PCR2000LA and PCR4000LA, always set this selector switch to the 170 V AC-250 V AC position.

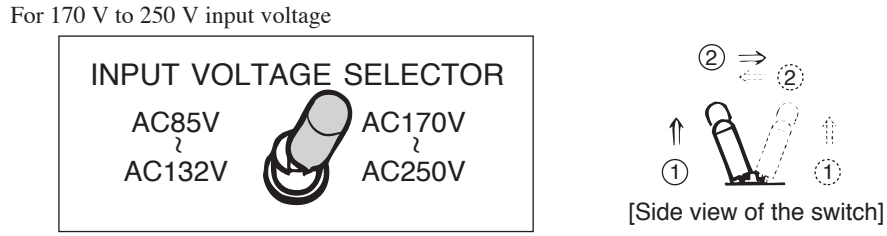


Fig. 2-9 INPUT VOLTAGE SELECTOR

The INPUT VOLTAGE SELECTOR is located at the center of the terminal box. It is a lock-type toggle switch. Pull the knob to select the input voltage.

⚠CAUTION
- Do not switch the INPUT VOLTAGE SELECTOR while power is fed to the power supply. Otherwise, a malfunction may occur.

2.5.2 Power Connection Cables

Connection of PCR-LA power supply outputs

Use the supplied power connection cables. Connect the cables from the three TO PCR-LA OUTPUT terminals of the Output Terminal to the OUTPUT terminal boards of the three PCR-LA AC power supplies. Be sure to confirm correspondence of the symbols “L,” “N,” and “G” between the TO PCR-LA OUTPUT terminals and the OUTPUT terminal boards.

OT01-PCR-LA/3			PCR-LA power supplies	
PCR-LA-1 (MASTER)	L1	←→	L	Master-unit OUTPUT terminal board
	N1	←→	N	
	G1	←→	G	
PCR-LA-2 (SLAVE1)	L2	←→	L	Slave-1-unit OUTPUT terminal board
	N2	←→	N	
	G2	←→	G	
PCR-LA-3 (SLAVE2)	L3	←→	L	Slave-2-unit OUTPUT terminal board
	N3	←→	N	
	G3	←→	G	

■ Cable types

5.5 mm^2/2.5 m for OT01-PCR6000LA/3
8 mm^2/2.5 m for OT01-PCR12000LA/3
14 mm^2/2.5 m for OT01-PCR18000LA/3

⚠CAUTION • Always use the supplied power connection cables.

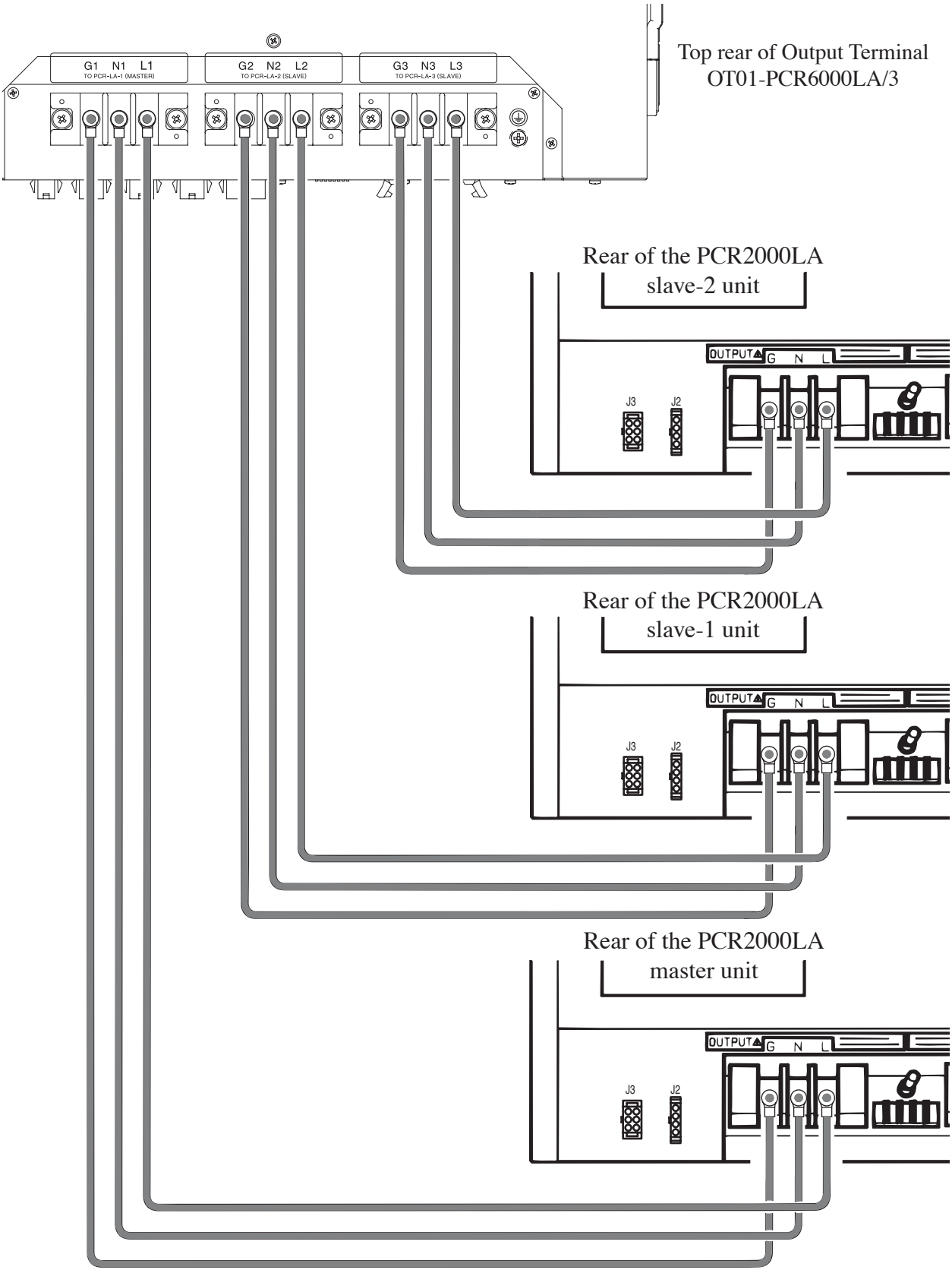


Fig. 2-10 Connection of the Power Connection Cables for OT01-PCR6000LA/3

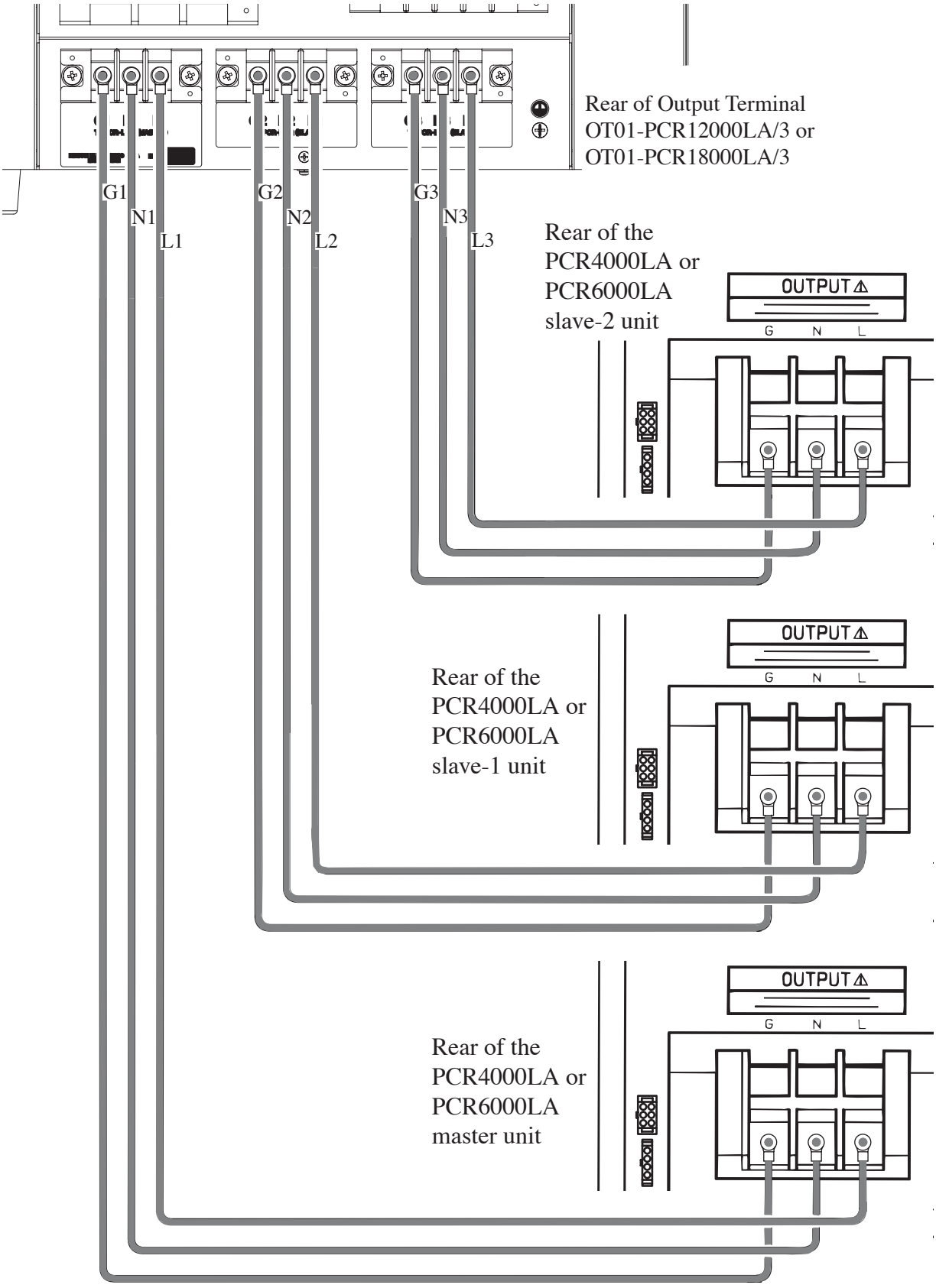


Fig. 2-11 Connection of the Power Connection Cables for OT01-PCR12000LA/3 or OT01-PCR18000LA/3

2.5.3 Signal Connection Cables

Use the supplied signal connection cables. Connections between the Output Terminal and PCR-LA power supplies are classified into six blocks:

1. Between the Output Terminal and the master PCR-LA power supply
2. Between the Output Terminal and the slave-1 PCR-LA power supply
3. Between the Output Terminal and the slave-2 PCR-LA power supply
4. Branching from the Output Terminal to the master, slave-1, and slave-2 PCR-LA power supplies
5. Between the master and slave-1 PCR-LA power supplies
6. Between the slave-1 and slave-2 PCR-LA power supplies

There are eight signal connection cables of five types.

For the driver signal connection cables of the Parallel Operation Driver or 3-phase Output Driver, see "2.5.4 Parallel Operation Driver" and "2.5.5 3-phase Output Driver".

Cable Names and Details of Connections

1. Connection between the Output Terminal and master PCR-LA power supply

Output Terminal		Cable name	Master PCR-LA power supply
TO PCR-LA-MASTER	TO J1	←→ Signal connection cable 1	J1*
	TO J4-1	←→ Signal connection cable 2	J4
TO PD03M-OT01-PCR-LA		←→ Signal connection cable 5	PD03M-OT01-PCR-LA (optional slot)

* This connection can be made to the J1 connector of the slave-1 PCR-LA power supply, depending on the convenience of the placement of the Output Terminal and PCR-LA power supplies.

2. Connection between the Output Terminal and slave-1 PCR-LA power supply

Output Terminal		Cable name	Slave-1 PCR-LA power supply
TO PCR-LA	TO J4-2	←→ Signal connection cable 2	J4

3. Connection between the Output Terminal and slave-2 PCR-LA power supply

Output Terminal		Cable name	Slave-2 PCR-LA power supply
TO PCR-LA	TO J4-3	←→ Signal connection cable 2	J4

4. Branching from the Output Terminal to the master, slave-1, and slave-2 PCR-LA power supplies

Output Terminal		Cable name Signal connection cable 4	SENSING terminals of the PCR-LA power supplies	
TO PCR-LA	TO SENSING	←→	White	Terminal L of the master unit
		←→	Black	Terminal N of the master unit
		←→	Black	Terminal L of the slave-1 unit
		←→	Red	Terminal N of the slave-1 unit
		←→	Red	Terminal L of the slave-2 unit
		←→	White	Terminal N of the slave-2 unit

Terminals to which cables of the same color (white, black, or red) are connected, are connected together within the Output Terminal. For connection to the PCR-LA power supplies, cables of a combination of different colors are used to distinguish between them.

5. Connection between the master and slave-1 PCR-LA power supplies

Master PCR-LA power supply	Cable name	Slave-1 PCR-LA power supply
J3	←→ Signal connection cable 3	J1

6. Connection between the slave-1 and slave-2 PCR-LA power supplies

Slave-1 PCR-LA power supply	Cable name	Slave-2 PCR-LA power supply
J3	←→ Signal connection cable 3	J1

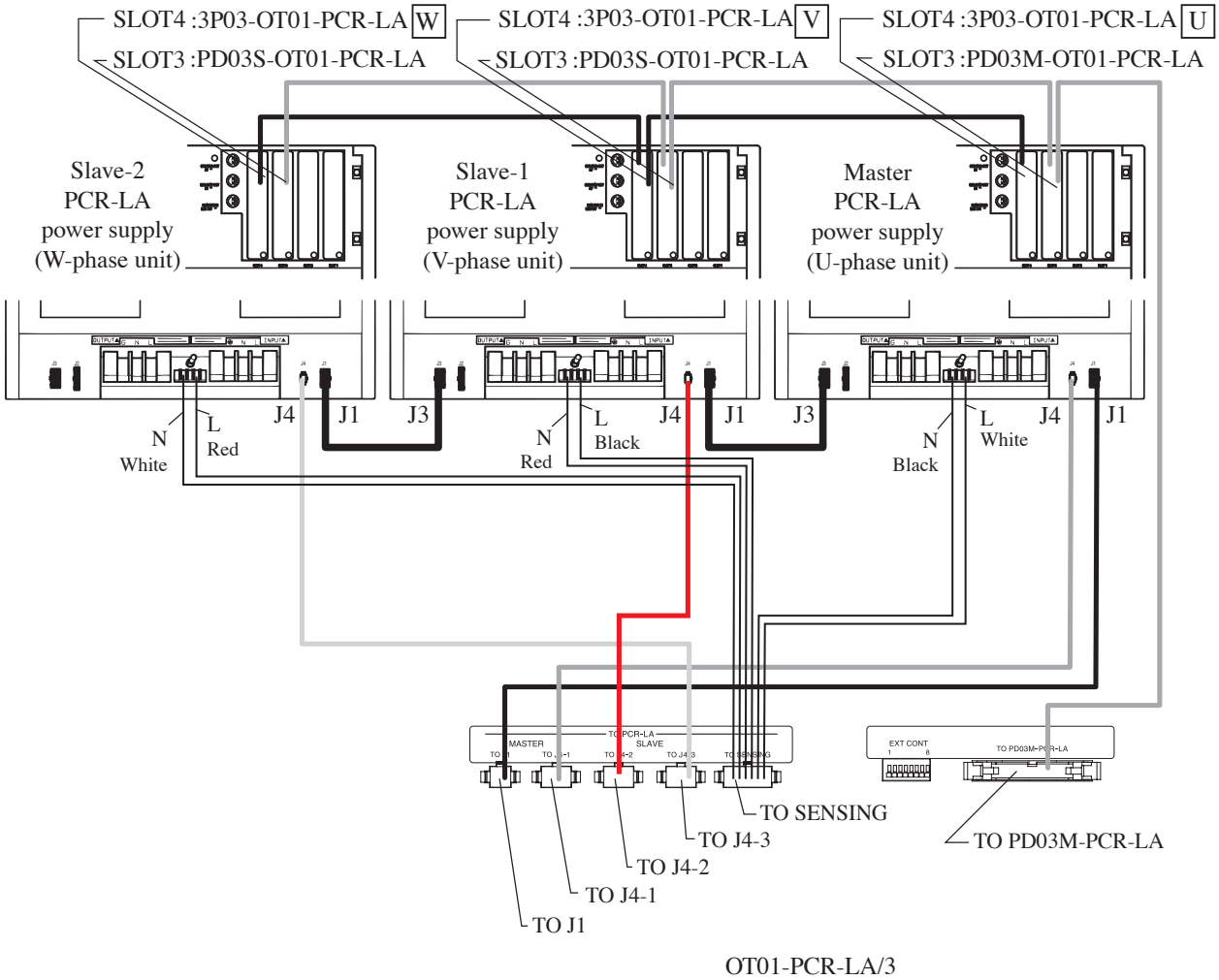


Fig. 2-12 Connection of Signal Connection Cables

2.5.4 Parallel Operation Driver

The Parallel Operation Driver consists of three parallel operation cards and drive-signal cables.

*PD03M-OT01-PCR-LA is a card for the master unit, while *PD03S-OT01-PCR-LAs are cards for slave units.

* These cards are designed especially for the Output Expansion Kits.

Setting a parallel operation address

The card (printed board) has DIP switches used to set a parallel operation address. Set this address as follows:

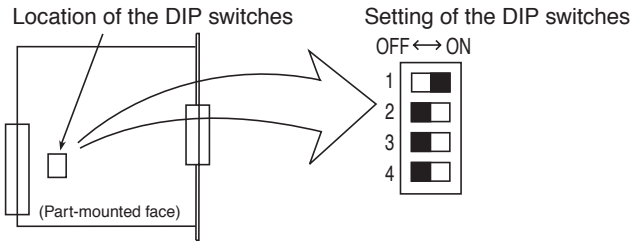


Fig. 2-13 Location of the DIP Switches

Table 2-1 Setting the DIP Switches

PD03M-OT01-PCR-LA	PD03S-OT01-PCR-LA	
Master	Slave 1	Slave 2
OFF ⟷ ON 1 2 3 4	OFF ⟷ ON 1 2 3 4	OFF ⟷ ON 1 2 3 4

The numbers of the slave units have no bearing on the placement of the power supplies. Assign a different address to each slave unit (PD03S-OT01-PCR-LA).

Installing the cards in the PCR-LA power supplies

Install one parallel operation card in SLOT3 of each of the three PCR-LA power supplies.

PD03M-OT01-PCR-LA is the master-unit card. The PCR-LA power supply equipped with this card plays the role of the master unit for parallel operation. It is recommended that the master power supply be installed in locations that are easy to access for easy operation.

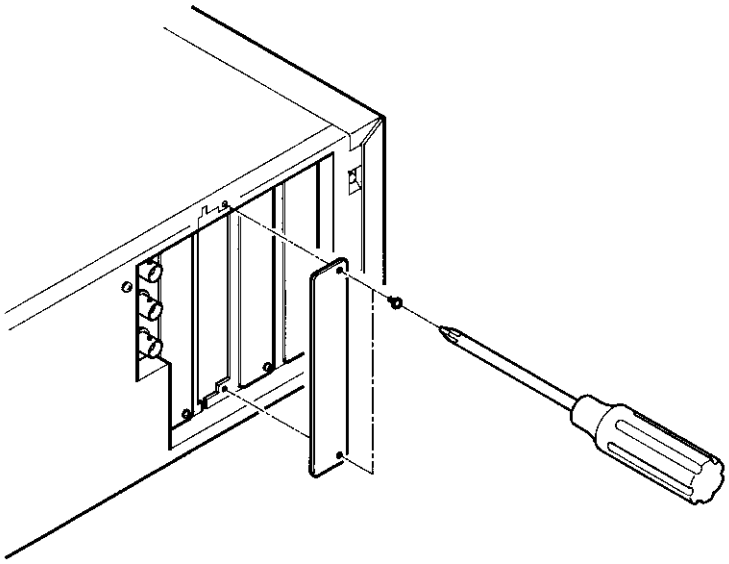


Fig. 2-14 Installing a Card in the Slot in a PCR-LA Power Supply

1. Remove the screws fixing the SLOT3 cover to remove the cover. (Keep the removed cover to ensure that it is not lost.)
2. Hold each card so that the part-mounted side of the printed board is at the right, and insert the board into the slot grooves.
3. Insert the card into the slots carefully so that the board does not come out of the grooves. After inserting the card as far as it will go, fix the card to the PCR-LA power supply using the screws supplied with the driver.
4. This completes installation of a card in the slot.

■ Connecting the drive-signal cables

5. Connect the master-unit card to a slave-unit card or a slave-unit card to the other slave-unit card, using a drive-signal cable (26 poles).

   In this case, the order of connection does not matter.

Example of the arrangement of the power supplies ("M" represents the master unit and "S" a slave unit.)

M	←→	S	←→	S

S	←→	M	←→	S

6. Open the tabs of the J1 connectors of each card, orient the connector of a drive-signal cable to a J1 connector, and insert it into the J1 connector. The J1 connector has two connection ports, each of which operates the same way. For the unit located at the center of the three PCR-LA power supplies, two drive-signal cables are connected to the J1 connector. Thus, both slots of the connector will be used.

7. Close the tabs of the J1 connectors to lock the cable connectors.

   This completes the connection of a drive-signal cable.

⚠ CAUTION
- Do not move a PCR-LA power supply with a drive-signal cable(s) connected to the card. Otherwise, excessive force will be exerted on the cable and connector, which could result in breakage of the card.
- Before moving the PCR-LA power supply, be sure to disconnect the drive-signal cable(s).

2.5.5 3-phase Output Driver

The 3-phase Output Driver consists of three three-phase operation cards (*3P03-OT01-PCR-LA) and drive-signal cables.

* These cards are especially designed for the Output Expansion Kits.

Installing the cards in the PCR-LA power supplies

Install one three-phase operation card (3P03-OT01-PCR-LA) in SLOT4 of each of the three PCR-LA power supplies. Install the U-phase card in the power supply set up as the master unit for the single-phase operation cards, the V-phase card in the power supply set up as the slave-1 unit, and the W-phase card in the power supply set up as the slave-2 unit.

The PCR-LA power supply equipped with the U-phase card plays the role of the master unit for three-phase operation. It is recommended that the master power supply be installed in locations that are easy to access for easy operation.

For installation of a card in the slot of a PCR-LA power supply, see Fig. 2-14. Note that the three-phase operation cards are installed in SLOT4.

1. Remove the screws fixing the SLOT4 cover to remove the cover. (Keep the removed cover to ensure that it is not lost.)
2. Hold each card so that the part-mounted side of the printed board is at the right, and insert the board into the slot grooves.
3. Insert the card into the slots carefully so that the board does not come out of the grooves. After inserting the card as far as it will go, fix the card to the PCR-LA power supply using the screws supplied with the driver.

   This completes installation of a card in the slot.

■ Connecting the drive-signal cables

4. Connect the U-, V-, and W-phase cards using two drive-signal cables (34 poles).

Example:

U ←→ V ←→ W

V ←→ U ←→ W

Both examples of connection work in the same way.

5. Open the tabs of the J1 connectors for the U-, V-, or W-phase card, and align the orientation of the connectors of a drive-signal cable with that of the J1 connectors to insert the cable connectors into the J1 connectors. The J1 connector has two connection ports, each of which operates the same way. For the unit located at the center of the three PCR-LA power supplies, two drive-signal cables are connected to the J1 connector. Thus, both slots of the connector will be used.
6. Close the tabs of the J1 connectors to lock the cable connectors.
7. Fasten the crimp terminals (at both ends of the cable) shown in Fig. 2-15 to a card-fixing screw.

   This completes the connection of a drive-signal cable.

⚠ CAUTION • Do not move a PCR-LA power supply with a drive-signal cable(s) connected to the card. Otherwise, excessive force will be exerted on the cable and connector, which could result in breakage of the card.

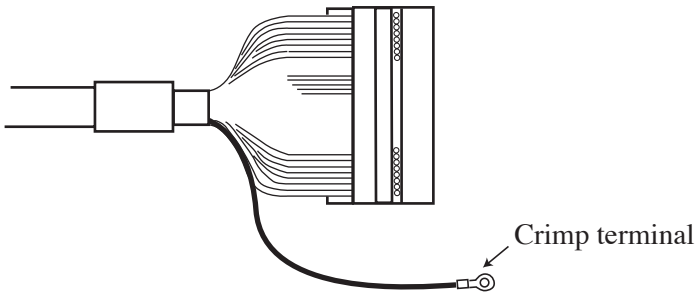


Fig. 2-15 Drive-signal Cable (34 Poles)

2.5.6 Summary of System Connections

The following diagram summarizes the connections of the input power cables of the three PCR-LA power supplies, the power connection cables, the signal connection cables, the Parallel Operation Driver, and the 3-phase Output Driver. Each cable is represented in simplified form.

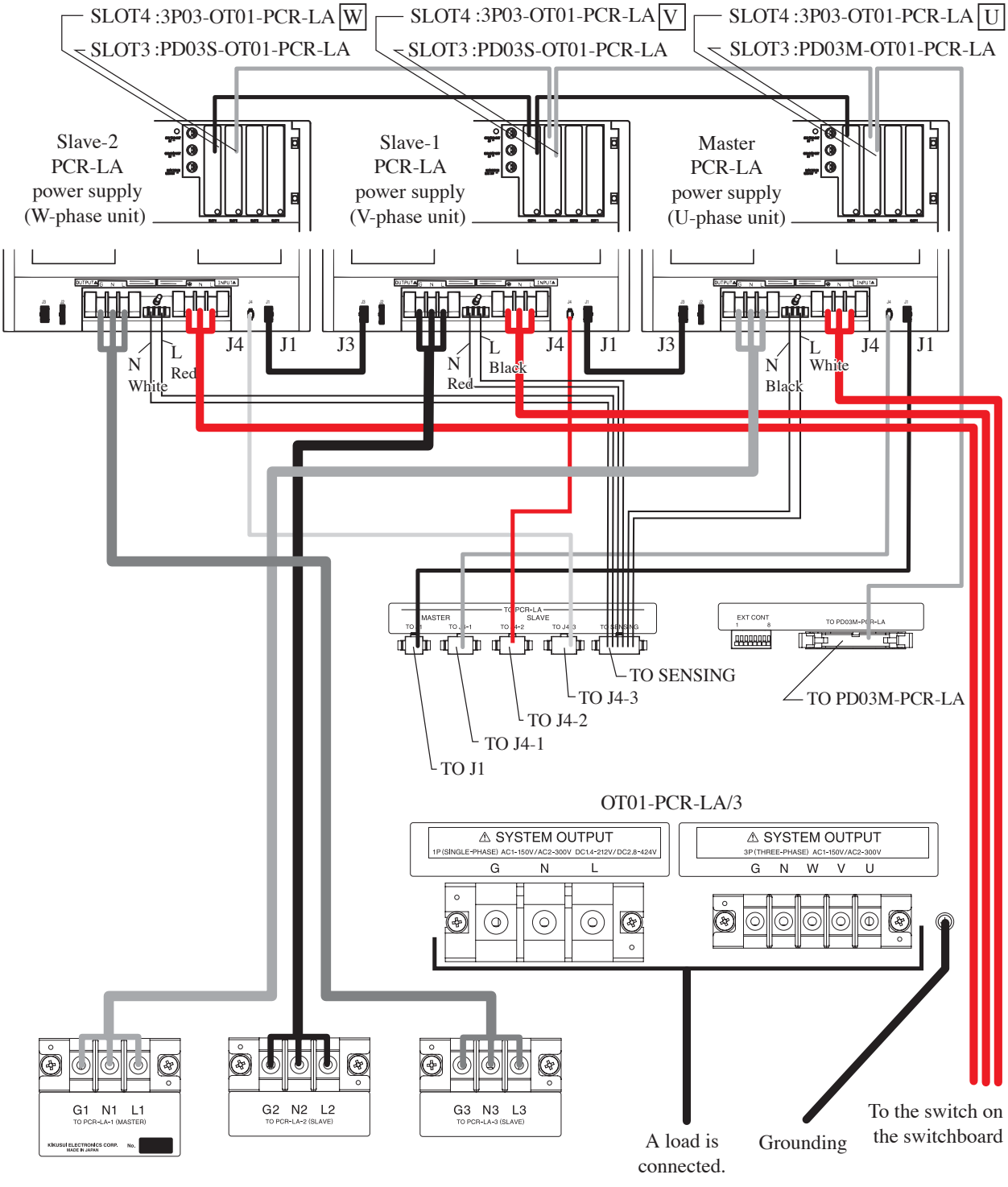


Fig. 2-16 Overall System Connection Diagram (OT01-PCR6000LA/3)

Table 2-2 System Connection (not Including PCR-LA Power Supply Input Power Cables)

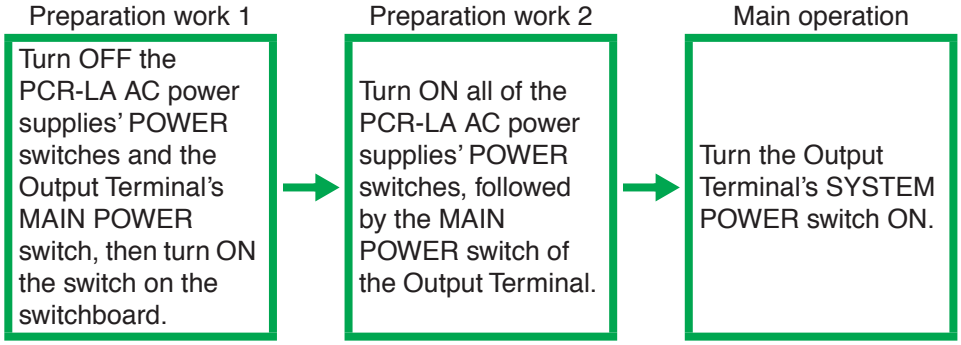
	Cable name, wire symbol	OT01-PCR-LA/3 terminal		Master PCR-LA unit's terminals		Slave-1 PCR-LA unit's terminals		Slave-2 PCR-LA unit's terminals	Remarks
Power connection cables									
	G1	TO PCR-LA-1 G1	←→	OUTPUT G					For power, 2.5 m
	N1	TO PCR-LA-1 N1	←→	OUTPUT N					
	L1	TO PCR-LA-1 L1	←→	OUTPUT L					
	G2	TO PCR-LA-2 G2			←→	OUTPUT G			
	N2	TO PCR-LA-2 N2			←→	OUTPUT N			
	L2	TO PCR-LA-2 L2			←→	OUTPUT L			
	G3	TO PCR-LA-3 G3					←→	OUTPUT G	
	N3	TO PCR-LA-3 N3					←→	OUTPUT N	
	L3	TO PCR-LA-3 L3					←→	OUTPUT L	
Signal connection cables									
	1	TO J1	←→	J1*					Wires with connectors
	2	TO J4-1	←→	J4					
	5	TO PD03M-OT01-PCR-LA	←→	PD03M-OT01-PCR-LA					
	2	TO J4-2			←→	J4			
	2	TO J4-3					←→	J4	
	4	TO SENSING	←→	L,N					
					←→	L,N			
							←→	L,N	
	3			J3	←→	J1			
	3					J3	←→	J1	
Parallel Operation Driver									
	Drive-signal cables (26-pin)			PD03M-OT01-PCR-LA	←→	PD03S-OT01-PCR-LA			Wires with connectors
						PD03S-OT01-PCR-LA	←→	PD03S-OT01-PCR-LA	
3-phase Output Driver									
	Drive-signal cables (34-pin)			3P03-OT01-PCR-LA	←→	3P03-OT01-PCR-LA			Wires with connectors
						3P03-OT01-PCR-LA	←→	3P03-OT01-PCR-LA	

* This connection can be made to the J1 connector of the slave-1 PCR-LA power supply, depending on the convenience of the placement of the Output Terminal and PCR-LA AC power supplies.

2.6 Power ON

Outline of the power-on procedure

Turn the power on with no load connected to the Output Terminal's SYSTEM OUTPUT terminal. To turn ON the power to the entire system, use the Output Terminal's SYSTEM POWER switch.



Power-on procedure

1. Turn the PCR-LA AC power supplies' POWER switches OFF.
2. Turn the Output Terminal's MAIN POWER switch OFF.
3. Check to confirm that no load is connected to the OUTPUT outlet at the lower front of the PCR-LA power supplies.
4. Turn ON the switch on the switchboard.
5. The LINE lamps at the lower front of the PCR-LA power supplies light up.

   If a LINE lamp does not light up, the relevant PCR-LA power supply is assumed to be faulty. Turn the switch on the switchboard OFF, and contact Kikusui distributor/agent.
6. Turn ON all of the PCR-LA AC power supplies' POWER switches.

   This causes the system to enter standby status.
7. Turn the Output Terminal's MAIN POWER switch ON.

   This causes the SYSTEM POWER switch's OFF lamp (red) and the WIRING switch's 1P lamp (white) to light up.
8. Turn the Output Terminal's SYSTEM POWER switch ON.

   This causes the power to the PCR-LA power supplies to turn ON. The ON lamp (green) of the Output Terminal's SYSTEM POWER switch lights up.
9. Check to confirm that the displays of the PCR-LA power supplies' control panels indicate the information shown in Fig. 2-17.

■ Version display

The control panels display version information. During this period, "SELF TEST" blinks (the PCR-LA power supplies are conducting an internal check).

The self-test time is a few seconds for single-phase parallel operation, and 20 to 30 seconds for three-phase output operation.

The version appears as V3. XX (XX: numbers) in the current display area.

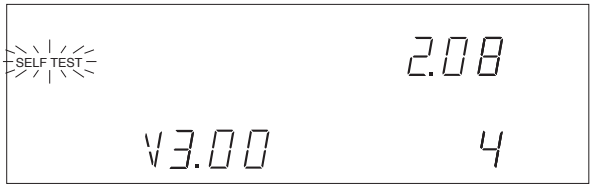


Fig. 2-17 Version Display Screen (Example of version 3.00)

■ Home Position action

After the version information is displayed, if no abnormality is detected in the self-test, the AC power supplies enter the Home Position.

In this case, if "ALARM" lights up, an alarm has occurred.

If the ALARM indication lights up and "Err X" (X: number) appears, see the protective functions in the PCR-LA AC Power Supply Operation Manual.

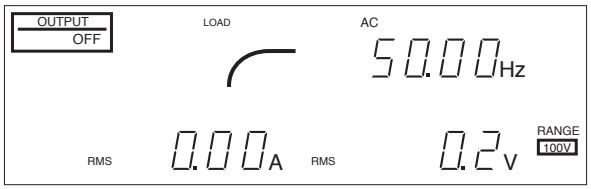


Fig. 2-18 Home Position Display

NOTE

- When the SYSTEM POWER switch is turned ON, all indications on the control panel are momentarily lit up. If this condition (lighting of all indications) remains even after a few seconds have elapsed, turn the SYSTEM POWER switch OFF and wait for more than 5 seconds, then turn it ON again.
- The status immediately after the POWER SWITCH is turned ON is referred to as the "Home Position" (regardless whether the OUTPUT is ON/OFF). To return to the Home Position from another status, press the ESC key.

10. If no abnormality occurs after this procedure is performed, the power-ON operation check is complete.

⚠ CAUTION

- Do not turn the SYSTEM POWER switch OFF and then immediately ON again. Otherwise, problems may occur. Wait for more than 5 seconds after turning the SYSTEM POWER switch OFF, before turning it ON again.

To perform an operation check of the PCR-LA power supplies, see the PCR-LA AC Power Supply Operation Manual.

2.7 Operation Check

This section describes the operation check to be performed in single-phase parallel operation and three-phase operation. If you are conducting an operation check for the first time, be sure to first gain an understanding of the operation procedure of the PCR-LA power supply.

2.7.1 Single-phase Parallel Operation

In single-phase parallel operation, the control panel display differs from that when a PCR-LA power supply is operated singly.

Operation procedure

■ Operation of the Output Terminal

1. Turn the SYSTEM POWER switch OFF.

   The WIRING switch can be operated only when the SYSTEM POWER switch is OFF.

2. Press the WIRING switch's 1P button.

   The 1P lamp lights up. The 1P lamp also lights up when the power is turned ON.

3. Turn the SYSTEM POWER switch ON.

■ Operation of the PCR-LA power supplies

4. Check the master- and slave-unit control panel displays.

Master unit's display

The master-unit control panel displays the same indications as when a PCR-LA power supply is operated singly. The ammeter indicates the total output current value of the master and slave units.

Slave units' displays

A parallel operation address (1-digit figure) appears in the frequency display area of each control panel.

Follow the operation check procedure for a PCR-LA power supply.

For more information on this, see the PCR-LA AC Power Supply Operation Manual.

2.7.2 Three-phase Operation

In three-phase operation, the control panel display differs from that when a PCR-LA power supply is operated singly.

Operation procedure

■ Operation of the Output Terminal

1. Turn the SYSTEM POWER switch OFF.

   The WIRING switch can be operated only when the SYSTEM POWER switch is OFF.

2. Press the WIRING switch's 3P button.

   The 3P lamp lights up.

3. Turn the SYSTEM POWER switch ON.

■ Operation of the PCR-LA power supply (U-phase unit)

For details, see the PCR-LA AC Power Supply Operation Manual. The basic operations are the same as those for single-phase parallel operations. Note that in three-phase operation, a voltage display can be selected as described below.

4. Press the PHASE (SHIFT, 2) key to display the line voltage.
5. Press the PHASE (SHIFT, 2) key again to display the phase voltage.

   This causes the display voltage value to return to the original indication (phase voltage display).

Display common to each phase

The three-phase symbol ⅄ and the letter "U," "V," or "W" appear at the left of the voltage display area. In this case, the letters indicate that the PCR-LA power supplies have been set to their respective phases. The voltage display value set at factory shipment is the phase voltage.

If the letters U-V, V-W, or W-U are displayed at the left of the voltage display area, the PCR-LA power supplies display the respective line voltages.

V- and W-phase unit displays

The control panels display only the phase (V or W) indication, voltage and current indications, and the load level meter.

U-phase unit display

When the three-phase symbol ⅄ and all of the letters "U," "V," and "W" appear at the left of the current display area during power display, the total power of the three phases is indicated.

If the three-phase symbol ⅄ and the letter "U," "V," or "W" appear at the left of the current display area during a self-test, the U-phase power supply displays the self-test results for each indicated phase.

2.8 Connecting a Load

Connection to the Output Terminal's SYSTEM OUTPUT Terminal Board

Connect a load to one of the SYSTEM OUTPUT terminal boards according to the load type, single-phase or three-phase load.

■ Type of output terminal cover

Model name	Type of output terminal cover
OT01-PCR6000LA/3	Terminal-board-specific cover
OT01-PCR12000LA/3	Overall terminal section cover at the rear of the Output Terminal
OT01-PCR18000LA/3	

■ Connection procedure

1. Turn the Output Terminal's SYSTEM POWER switch OFF. Then, turn the switch on the switchboard OFF to shut off the power from the switchboard.
2. Remove the output terminal cover.
3. Securely connect the output cables for a load to the SYSTEM OUTPUT terminal board.

   For a single-phase load, connect the cables to the 1P (L, N, G) terminal.

   For a three-phase load, connect the cables to the 3P (U, V, W, N, G) terminal.
4. If the load has a grounding (GND) terminal, always make a connection between this terminal and the G terminal of the Output Terminal's SYSTEM OUTPUT terminal board.

   In this case, always use a grounding cable of a size equal to or greater than the wire size of the output cables.
5. Put the removed output terminal cover back on.

⚠WARNING • For OT01-PCR6000LA/3, in order to prevent electric shock, do not remove the terminal board cover of a SYSTEM OUTPUT terminal that is not used.

NOTE • Terminals L and N of the PCR-LA power supply's OUTPUT terminal board are isolated from the line voltage, so their polarity will not cause any safety problems. However, because the polarity is relevant in the synchronized mode (synchronous with the line voltage) or the DC mode, check the load polarity prior to connection. Grounding can be provided at either L or N.

The following shows the rated output capacities of the output-switching systems for reference purposes.

Model name	Number of PCR-LA	Rated output capacity
OT01-PCR6000LA/3	Three PCR2000LAs	6 kVA
OT01-PCR12000LA/3	Three PCR4000LAs	12 kVA
OT01-PCR18000LA/3	Three PCR6000LAs	18 kVA

3

Chapter 3 Output Switching (Operation of the Output Terminal)

Describes output-switching operations of the Output Terminal configured as a single phase/three-phase switching system.

3.1 Panel Operation

This section describes the operations of the Output Terminal front panel.

Overview of switch operation

■ Operating the WIRING switch

When the MAIN POWER switch is turned ON, the WIRING switch is always set to 1P (single-phase). Press the desired button for the WIRING switch, then turn the SYSTEM POWER switch ON. Once the SYSTEM POWER switch is turned ON, operation of the WIRING switch is disabled. This feature is intended to prevent output switching in the power-supplied status.

POWER switches on the PCR-LA power supplies

All of the PCR-LA AC power supplies' POWER switches must be turned ON in advance. For more information, see "2.6 Power ON".

■ System operation method

The WIRING switch determines the operation method of the output-switching system, including the PCR-LA power supplies. When 1P is selected, the PCR-LA power supplies perform single-phase parallel operations. When 3P is selected, they perform three-phase output operation.

3.1.1 Single-phase Parallel Operation

Output selection procedure

1. Turn the MAIN POWER switch ON.
   The SYSTEM POWER switch's OFF lamp (red) lights up. The WIRING switch's 1P lamp lights up.
   This indicates that single-phase (1P) output is selected.
2. Turn the SYSTEM POWER switch ON.
   The SYSTEM POWER switch's ON lamp (green) lights up.

When next applying power to a load

3. Operate the PCR-LA power supply (master unit) to set an output voltage and frequency.
4. Turn the OUTPUT of the PCR-LA power supply (master unit) ON.
   For more information, see the PCR-LA AC Power Supply Operation Manual.

3.1.2 Three-phase Operation

Output selection procedure

1. Turn the MAIN POWER switch ON.
   The SYSTEM POWER switch's OFF lamp (red) lights up. The WIRING switch's 1P lamp lights up.
2. Press the WIRING switch's 3P (three-phase) button.
   The WIRING switch's 3P lamp lights up, indicating that three-phase (3P) output has been selected.
3. Turn the SYSTEM POWER switch ON.
   The SYSTEM POWER switch's ON lamp (green) lights up.

When next applying power to a load

4. Operate the PCR-LA power supply (U-phase unit) to set an output voltage and frequency.
5. Turn the OUTPUT of the PCR-LA power supply (U-phase unit) ON.
   For more information, see the PCR-LA AC Power Supply Operation Manual.

3.1.3 Shutting Down the Power in an Emergency

If any problem occurs in a load or cable, shut down the power to the system.

Shutdown procedure

1. Turn the MAIN POWER switch OFF.
   This shuts down the power to the entire system.
2. Turn the line voltage switch on the switchboard OFF.
   This completely shuts down the power to the system.
3. To ensure safety, turn OFF all of the PCR-LA AC power supplies' POWER switches.

Turning the power on again

1. Confirm that the cause of the abnormality has been eliminated.
2. Turn the line voltage switch on the switchboard ON.
   The PCR-LA power supplies' LINE lamps light up.
3. Turn the POWER switch of each PCR-LA AC power supply ON.
4. Turn the MAIN POWER switch ON.

5. Turn the SYSTEM POWER switch ON.

This turns power to the entire system ON.

Turning the OUTPUT of the PCR-LA power supply (U-phase unit) ON enables the supply of power to the load.

3.2 External Control

Using external contacts, the SYSTEM POWER switch can be turned ON/OFF and the WIRING switch can be controlled. Even during external control, the switches on the Output Terminal front panel are always enabled.

For external control, use the EXT CONT terminal.

■ Terminal names and numbers

Terminal number	1	2	3	4	5	6	7	8
Terminal name	P-OFF+	P-OFF-	P-ON+	P-ON-	1P+	1P-	3P+	3P-

■ Terminal functions

To turn the SYSTEM POWER switch OFF, short-circuit terminals numbers 1 and 2.

To turn the SYSTEM POWER switch ON, short-circuit terminals numbers 3 and 4.

To select 1P of the WIRING switch, short-circuit terminals numbers 5 and 6.

To select 3P of the WIRING switch, short-circuit terminals numbers 7 and 8.

■ Available wires

Single wire: Wire diameter of 0.32 mm (AWG28) to 0.65 mm (AWG22)

Twisted wire: Conductor cross-sectional area of 0.08 mm^2 (AWG28) to 0.32 mm^2 (AWG22)

Individual wire diameter: 0.125 mm or more

Wire peeling-off length: 9 mm to 10 mm

Chapter 4 Part Names and Functions
(Output Terminal)

Denotes the names of switches, displays, terminals, and other parts on the front and rear panels of the Output Terminal. Also describes their functions.

4.1 OT01-PCR6000LA/3

4.1.1 Front Panel

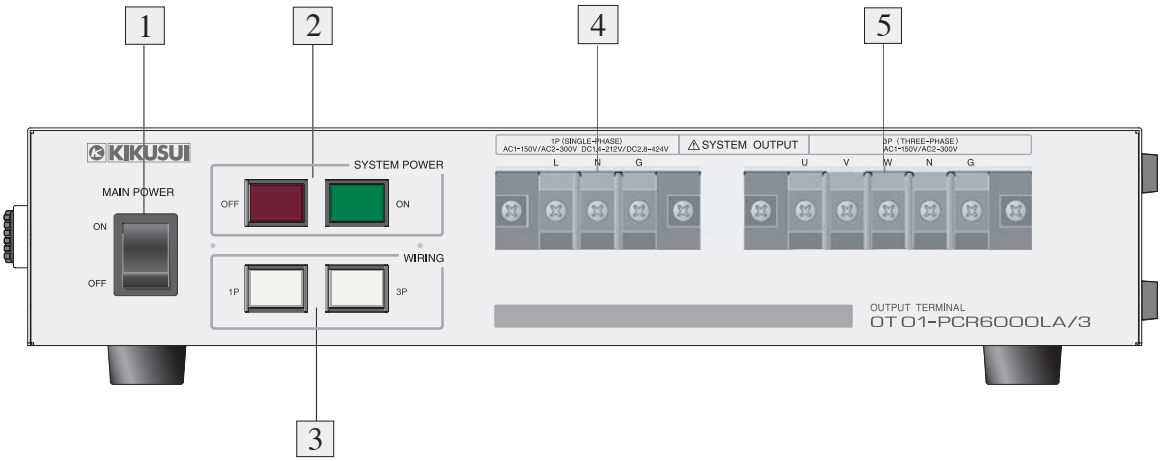


Fig. 4-1 Front Panel Operating Section

[1] MAIN POWER switch

This is the power switch for the Output Terminal. Turning this switch ON enables startup of the control section of the output switching system. This allows the SYSTEM POWER switch to be used to change the output.

[2] SYSTEM POWER switch

This is the power switch for the entire system. Turning this switch ON causes the PCR-LA power supplies' POWER switches to turn ON, enabling them to be operated. (Note that the PCR-LA AC power supplies' POWER switches must be turned ON in advance.)

[3] WIRING switch

This is an output selector switch. It enables selection of 1P (single-phase) or 3P (three-phase).
This switch can be operated only when the SYSTEM POWER switch is OFF.
When the MAIN POWER switch is turned ON, the Output Terminal selects 1P (single-phase) automatically.

[4] SYSTEM OUTPUT-1P terminal board

This is the single-phase output terminal board for an output-switching system. This terminal board is available when the WIRING switch is in the 1P position. When 1P is not selected, the terminals on this terminal board are open.

[5] SYSTEM OUTPUT-3P terminal board

This is the three-phase output terminal board for an output-switching system. This terminal board is available when the WIRING switch is in the 3P position. When 3P is not selected, the terminals on this terminal board are open.

4.1.2 Rear Panel

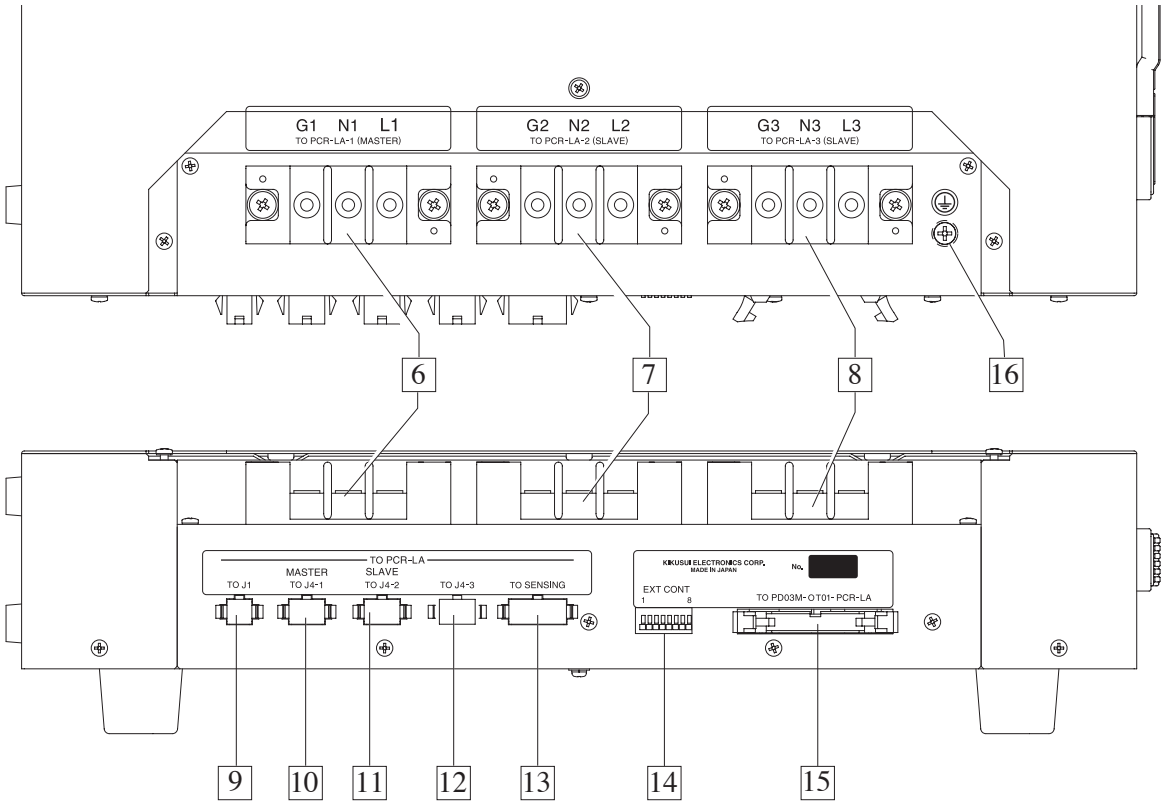


Fig. 4-2 Rear Panel Operating Section

[6] TO PCR-LA-1 (MASTER) terminal board

Using the supplied power connection cables, make connections between this terminal board and the master PCR-LA power supply's OUTPUT terminal board. In this case, connect the cables so that the letters "L," "N," and "G" on this terminal board correspond to those on the master PCR-LA power supply.

[7] TO PCR-LA-2 (SLAVE) terminal board

Using the supplied power connection cables, make connections between this terminal board and the slave-1 PCR-LA power supply's OUTPUT terminal board. In this case, connect the cables so that the letters "L," "N," and "G" on this terminal board correspond to those on the slave-1 PCR-LA power supply.

[8] TO PCR-LA-3 (SLAVE) terminal board

Using the supplied power connection cables, make connections between this terminal board and the slave-2 PCR-LA power supply's OUTPUT terminal board. In this case, connect the cables so that the letters "L," "N," and "G" on this terminal board correspond to those on the slave-2 PCR-LA power supply.

[9] TO J1 connector

Using a supplied signal connection cable, make a connection between this connector and the master PCR-LA power supply's J1 connector.

[10] TO J4-1 MASTER connector

Using a supplied signal connection cable, make a connection between this connector and the master PCR-LA power supply's J4 connector.

[11] TO J4-2 SLAVE connector

Using a supplied signal connection cable, make a connection between this connector and the slave-1 PCR-LA power supply's J4 connector.

[12] TO J4-3 SLAVE connector

Using a supplied signal connection cable, make a connection between this connector and the slave-2 PCR-LA power supply's J4 connector.

[13] TO SENSING connector

This connector sends out a line voltage signal. Using the supplied signal connection cables, make connections between this connector and the PCR-LA power supplies' SENSING terminal boards.

[14] EXT CONT terminal

This is for external contact inputs for the SYSTEM POWER switch and WIRING switch.

[15] TO PD03M-OT01-PCR-LA connector

This connector outputs a 1P/3P switching signal. Using the supplied signal connection cable, connect this connector to PD03M-OT01-PCR-LA in the master PCR-LA power supply.

[16] ⏚

Grounding terminal

4.2 OT01-PCR12000LA/3 or OT01-PCR18000LA/3

4.2.1 Front Panel

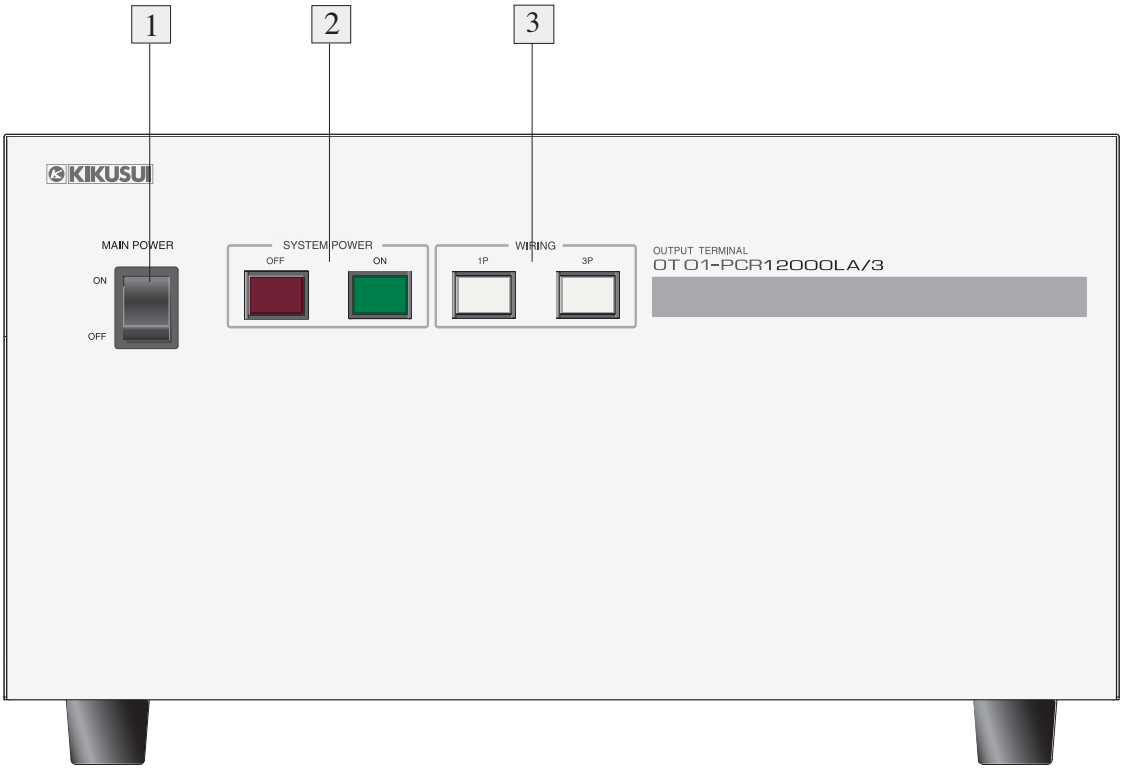


Fig. 4-3 Front Panel Operating Section

[1] MAIN POWER switch

This is the power switch for the Output Terminal. Turning this switch ON enables startup of the control section of the output switching system. This allows the SYSTEM POWER switch to be used to change the output.

[2] SYSTEM POWER switch

This is the power switch for the entire system. Turning this switch ON causes the PCR-LA power supplies' POWER switches to turn ON, enabling them to be operated. (Note that the PCR-LA AC power supplies' POWER switches must be turned ON in advance.)

[3] WIRING switch

This is an output selector switch. It enables selection of 1P (single-phase) or 3P (three-phase).

This switch can be operated only when the SYSTEM POWER switch is OFF.

When the MAIN POWER switch is turned ON, the Output Terminal selects 1P (single-phase) automatically.

4.2.2 Rear Panel

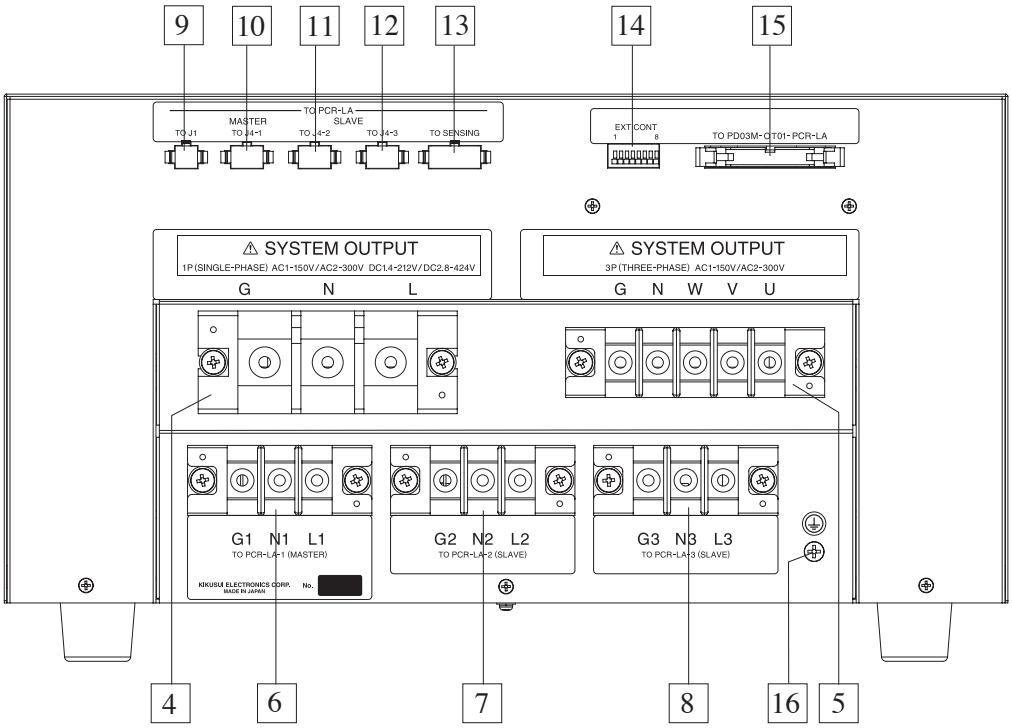


Fig. 4-4 OT01-PCR12000LA/3 Rear Panel Operating Section

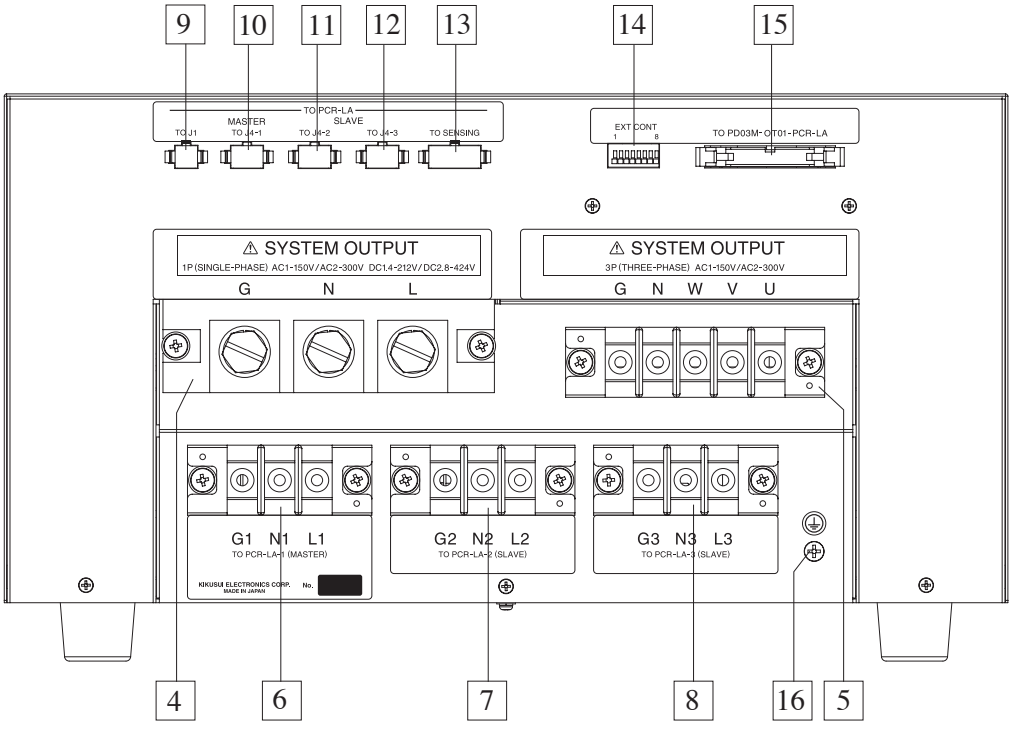


Fig. 4-5 OT01-PCR18000LA/3 Rear Panel Operating Section

[4] SYSTEM OUTPUT-1P terminal board

This is the single-phase output terminal board for an output switching system. This terminal board is available when the WIRING switch is in the 1P position. When 1P is not selected, the terminals on this terminal board are open.

[5] SYSTEM OUTPUT-3P terminal board

This is the three-phase output terminal board for an output switching system. This terminal board is available when the WIRING switch is in the 3P position. When 3P is not selected, the terminals on this terminal board are open.

[6] TO PCR-LA-1 (MASTER) terminal board

Using the supplied power connection cables, make connections between this terminal board and the master PCR-LA power supply's OUTPUT terminal board. In this case, connect the cables so that the letters "L," "N," and "G" on this terminal board correspond to those on the master PCR-LA power supply.

[7] TO PCR-LA-2 (SLAVE) terminal board

Using the supplied power connection cables, make connections between this terminal board and the slave-1 PCR-LA power supply's OUTPUT terminal board. In this case, connect the cables so that the letters "L," "N," and "G" on this terminal board correspond to those on the slave-1 PCR-LA power supply.

[8] TO PCR-LA-3 (SLAVE) terminal board

Using the supplied power connection cables, make connections between this terminal board and the slave-2 PCR-LA power supply's OUTPUT terminal board. In this case, connect the cables so that the letters "L," "N," and "G" on this terminal board correspond to those on the slave-2 PCR-LA power supply.

[9] TO J1 connector

Using a supplied signal connection cable, make a connection between this connector and the master PCR-LA power supply's J1 connector.

[10] TO J4-1 MASTER connector

Using a supplied signal connection cable, make a connection between this connector and the master PCR-LA power supply's J4 connector.

[11] TO J4-2 SLAVE connector

Using a supplied signal connection cable, make a connection between this connector and the slave-1 PCR-LA power supply's J4 connector.

[12] TO J4-3 SLAVE connector

Using a supplied signal connection cable, make connections between this connector and the slave-2 PCR-LA power supply's J4 connector.

[13] TO SENSING connector

This connector sends out a line-voltage signal. Using the supplied signal connection cables, make connections between this connector and the PCR-LA power supplies' SENSING terminal boards.

[14] EXT CONT terminal

This is for external contact inputs for the SYSTEM POWER switch and WIRING switch.

[15] TO PD03M-OT01-PCR-LA connector

This connector outputs a 1P/3P-switching signal. Using the supplied signal connection cable, connect this terminal to PD03M-OT01-PCR-LA in the master PCR-LA power supply.

[16] ⏚

Grounding terminal

5

Chapter 5 Single-phase Parallel Operation (Operations of PCR-LA AC Power Supplies)

Describes the procedure for operation of the PCR-LA power supplies in single-phase parallel operation. For the method of operating a PCR-LA power supply singly, see the PCR-LA AC Power Supply Operation Manual.

5.1 Basic Operations

This section describes the operation method for the PCR-LA power supplies, which differs from the method of operating a PCR-LA AC power supply singly. For information not provided here, see the PCR-LA AC Power Supply Operation Manual.

Basic Operation for Parallel Operation

■ Controlling all PCR-LA power supplies from the master unit

In parallel operations, all PCR-LA power supplies are controlled from the master unit. Thus, the master power supply's control panel is operated.

NOTE

- When parallel operation is started, all PCR-LA power supplies are started up under the conditions (voltage, frequency, etc.) that have been set in the master unit.

■ Alarm occurrence

If an alarm occurs in one of the PCR-LA power supplies during parallel operation, the outputs of all PCR-LA power supplies are turned OFF.

■ Output current value

For the output current, the total value of the output currents of the master and slave units is displayed on the master PCR-LA power supply's control panel.

■ Slave-unit display

A parallel operation address (1-digit figure) appears in the frequency display area on the slave PCR-LA power supplies' control panels.

5.2 Setting Limit Values

Limit values are set from the master PCR-LA power supply. In particular, the current limit should be set with the current value in parallel operation taken into account.

When the PCR-LA power supplies perform parallel operation for the first time, the current limit value that has been set to the master unit applies to all power supplies. The voltage limits and frequency limits are also set to the values that have been set for the master unit.

For the setting procedure, see the PCR-LA AC Power Supply Operation Manual.

5.3 Steps to be Taken in the Event of an Alarm

If an alarm occurs, an intermittent buzzer tone will sound and "ALARM" will light up or "Err X" (X: number) will be displayed (for an Err X display, no buzzer sounds). In such a case, the protective function relevant to the cause of the error will operate to prevent an escalation of the problem and to protect the connected load from breakage.

NOTE

- If an alarm occurs, the AC power supply always turns the output OFF.
- There may not be a problem in the power supply, depending on the alarm type. In such a case, clear the alarm and use the power supply as usual.

Operating procedure

1. Always turn the SYSTEM POWER switch OFF.

   If any step other than this is taken, the ALARM indication may be cleared, preventing checking of the alarm type.

2. Wait for more than 5 seconds after turning the SYSTEM POWER switch OFF, then turn the switch ON again.

   If no alarm occurs, the AC power supply can continue to be used.

3. 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)

For parallel operation, the self-test function is integrally activated from the master unit's control panel.

4. While "ALARM" is lit, press the SELF TEST (SHIFT, 3) key.

   This will cause "No. X" to appear in the current display area and "Ad. X" to appear in the voltage display area.

5. Turn JOG. This will cause the content of the current display area and that of the voltage display area to change. Then, read the number displayed in the "No." area when "Ad. 0" appears.

   "Ad." is the number of a power unit in the AC power supply (Table 5-1).

6. Take measures corresponding to the displayed "No." in accordance with Table 5-2.

■ Alarm-clearing procedure (Alarm (8))

7. Press the ALAM CLR (SHIFT, CLR) key.

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

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

9. Check for an alarm from “Ad. 1” to the last Ad. number (the last Ad. number will differ by model) in the same way as in step 5.

If there is no alarm, the AC power supply can continue to be used.

If this check results in an alarm for all numbers, the power supply can no longer be used. Contact Kikusui distributor/agent.

Ad. Numbers to be displayed by SELF TEST

Table 5-1 Ad. Numbers

Ad.	Model concerned
0	All PCR-LA power supplies
1–2	PCR2000LA master unit
1–4	PCR4000LA master unit
1–6	PCR6000LA master unit
11–12	PCR2000LA slave-1 unit
11–14	PCR4000LA slave-1 unit
11–16	PCR6000LA slave-1 unit
21–22	PCR2000LA slave-2 unit
21–24	PCR4000LA slave-2 unit
21–26	PCR6000LA slave-2 unit

“Ad.” indicates the number of a power unit in the AC power supply. The power units are numbered sequentially from the top down.

Numbers in the No. area indicated by SELF TEST

Table 5-2 Err Numbers and Remedies (The section to be referred to in the Remedy column indicates the section number in the PCR-LA AC Power Supply Operation Manual.)

No.	Remedy
0	No alarm
1	The internal circuit protection has activated. **Contact Kikusui distributor/agent.**
2	The internal temperature is expected to be abnormally high. **Wait approx. 10 minutes with the power ON.** **If the alarm continues, perform the procedure specified in 2.5, Input Connections. If the alarm goes off, the power supply may be installed improperly. Check the description in “2.2 Precautions on Installation”.** **If nothing wrong is found in either of these steps, immediately stop using the power supply and contact Kikusui distributor/agent.**
3	The internal semiconductor protective function has activated. **See “8.5 Overload Protective Functions”.**

4	The internal circuit protective function has activated. **Immediately stop using the AC power supply and contact Kikusui distributor/agent.**
5	
6	The current limiting function has activated. **See "8.5 Overload Protective Functions".**
7	**The sensing function has been used improperly. See "4.5 Sensing Function".**
8	The power unit concerned may have been removed. This alarm can be cleared to use the system. However, the output capacity will be limited due to the fact that the power unit is not functioning. **See Alarm-clearing procedure (Alarm (8)).**

NOTE • When requesting a repair, inform us of this number.

Check to be Performed if "Err X" is Displayed

If an error occurs, the control panel will continue displaying "Err X" (X: number). If an Err display appears, always turn the POWER switch OFF and take steps in accordance with Table 5-3.

Table 5-3 Err Numbers and Remedies (The section to be referred to in the Remedy column indicates the section number in the PCR-LA AC Power Supply Operation Manual.)

Err X	Remedy
1	All internal power units are defective. **Immediately stop using the AC power supply and contact Kikusui distributor/agent.**
2	An error has occurred in signal communication between the PCR-LA power supplies or within a PCR-LA power supply. **Turn the SYSTEM POWER switch OFF and wait for more than 5 seconds, then turn the switch ON again. If no Err occurs, the power supply can continue to be used. If Err occurs again, contact Kikusui distributor/agent.**
4	An error has occurred in the AC power supply. **Turn the SYSTEM POWER switch OFF and wait for more than 5 seconds, then turn the switch ON with the MEM key held down. Then, perform a reset. This causes the power supply to enter the initial setup status.**
5	The input voltage is out of the rated range. **See "2.5 Input Connections".**
Other numbers	**Contact Kikusui distributor/agent.**

5.4 Ammeter's Zero Calibration Function

When the PCR-LA power supplies perform parallel operations for the first time, there may be an offset (indication of a slight value under no-load conditions) in the current, power, power factor, and apparent power indications, and in the analyzed harmonic current value, related to current measurements.

In such a case, RS-232C Control or one of the following options can be used to perform zero calibration. The zero calibration function works even when a load is connected. However, to ensure accurate calibration, perform zero calibration with no load connected.

■ One of the following options is required:

• RC04-PCR-LA (Remote Controller)

• IB03-PCR-LA (GPIB Interface)

To ensure accurate measurements, wait more than 30 minutes after turning the PCR-LA power supplies' POWER switches ON. Then, perform zero calibration immediately before starting measurement.

■ Settings on the PCR-LA power supplies

Make the following settings first when using either option.

Item	Setting
Voltage setting	DC mode
Current display mode	AVE
Voltage setting	0 V
OUTPUT switch	ON
Voltage output range	100 V or 200 V (range to be used)

■ The PCR-LA power supplies retain calibrated values.

Once zero calibration has been performed, the PCR-LA power supplies retain the calibrated values during operation (as long as the connections remain the same).

5.4.1 Zero Calibration Procedure When Using RC04-PCR-LA

Before performing the following procedure, be sure to also read through the RC04-PCR-LA Operation Manual.

1. Press the ESC key to select the Home Position.
2. Press the SHIFT key, followed by the MODE key.

3. Press the F1 key. This starts zero calibration and the following appears on the display unit:

When zero calibration ends several tens of seconds later, the following appears:

4. Press the ESC key to exit the zero calibration mode.

   The calibrated values will be stored in the PCR-LA power supply memory; however, conduct re-calibration in accordance with changes in ambient temperature.

5.4.2 Messages Available When Using the RS-232C or GPIB Interface

Be sure to also read through the PCR-LA AC Power Supply Operation Manual and the IB03-PCR-LA Operation Manual (when the GPIB Interface is used).

Use the CALPARA message to conduct zero calibration.

No other messages will be accepted until completion of zero calibration, i.e., for several tens of seconds. The calibrated values will be stored in the PCR-LA power supply memory. However, conduct re-calibration in accordance with changes in ambient temperature.

6

Chapter 6 Three-phase Operation (Operations of PCR-LA AC Power Supplies)

Describes the procedure for operation of the PCR-LA power supplies in three-phase operation. For the method for operating a PCR-LA power supply singly, see the PCR-LA AC Power Supply Operation Manual.

6.1 Basic Operations

This section describes the operation method for the PCR-LA power supplies, which differs from the method for operating a PCR-LA power supply singly. Unless otherwise specified, operation of a PCR-LA power supply refers to the U-phase unit.

For information not provided here, see the PCR-LA AC Power Supply Operation Manual.

Display during Three-phase Operation

■ Display common to each phase

The three-phase symbol ⅄ and the letter "U," "V," or "W" appear at the left of the voltage display area. In this case, the letters indicate that the PCR-LA power supplies have been set to their respective phases. The voltage display value set at factory shipment is the phase voltage.

If the letters U-V, V-W, or W-U are displayed at the left of the voltage display area, the PCR-LA power supplies display the respective line voltages.

■ V- and W-phase unit displays

The control panels display only the phase (V or W) indication, voltage and current indications, and the load level meter.

■ U-phase unit display

When the three-phase symbol ⅄ and all of the letters "U," "V," and "W" appear at the left of the current display area during power display, the total power of the three phases is indicated.

If the three-phase symbol ⅄ and the letter "U," "V," or "W" appear at the left of the current display area during a self-test, the U-phase power supply displays the self-test results for each indicated phase.

6.2 Switching of Output Voltage Display

There are the phase voltage display and line voltage display modes. In the factory shipment status, the PCR-LA power supplies enter the phase voltage display mode when the SYSTEM POWER switch is turned ON.

Procedure for switching between phase voltage and line voltage displays

1. Press the ESC key to select the Home Position.
2. Press the PHASE (SHIFT, 2) key.
   This changes the phase voltage display mode to the line voltage display mode.
3. To display the phase voltage, press the PHASE (SHIFT, 2) key again.

■ Conditions for entering the line voltage display mode

To switch from the phase voltage display mode to the line voltage display mode, the U-to-V phase difference must be 120 degrees and the U-to-W phase difference must be 240 degrees. In addition, the phase voltage settings for the U, V, and W phases must show the same value.

■ Limitations in the line voltage display mode

- Voltage can be set as line voltage. V- or W-phase voltage cannot be set individually.
- The U-to-V or U-to-W phase difference cannot be modified.
- Output power cannot be measured.

6.3 Output Voltage Setting

Phase voltage setting

When the phase voltage is set on the U-phase unit, the phase voltages of the other phase units are also set to the same value. U-phase unit setting has precedence over unit settings of other phases.

If the phase voltage is individually set on the V-phase unit, only the V-phase voltage is set. Similarly, setting the phase voltage on the W-phase unit enables only the W-phase voltage to be set. Then, if the phase voltage is re-set on the U-phase unit, the phase voltages of the V- and W-phase units become the same as the phase voltage of the U-phase unit (the U-phase unit has precedence over the other phase units).

Individual voltage setting on the V- or W-phase unit requires that the relevant PCR-LA power supply be in the phase voltage display mode.

NOTE

- The phase voltage is 1/1.73 ($\sqrt{3}$) of the line voltage. (This applies when the U-to-V phase difference is 120 degrees and the U-to-W phase difference is 240 degrees.)

Line voltage setting

Set the line voltage on the U-phase unit. The line voltage cannot be set on the V- or W-phase unit.

6.4 Limit Value Setting

Voltage limit value setting

Voltage limit values can be set only on the U-phase unit. The limit values set on the U-phase unit are valid for all phases. A voltage limit cannot be individually set for each phase.

A voltage limit value is a limit on the phase voltage; a line voltage limit operates at a value 1.73 ($\sqrt{3}$) times the phase voltage limit.

Frequency limit value setting

Frequency limit values can be set only on the U-phase unit. The limit values set on the U-phase unit apply to all phases. A frequency limit cannot be individually set for each phase.

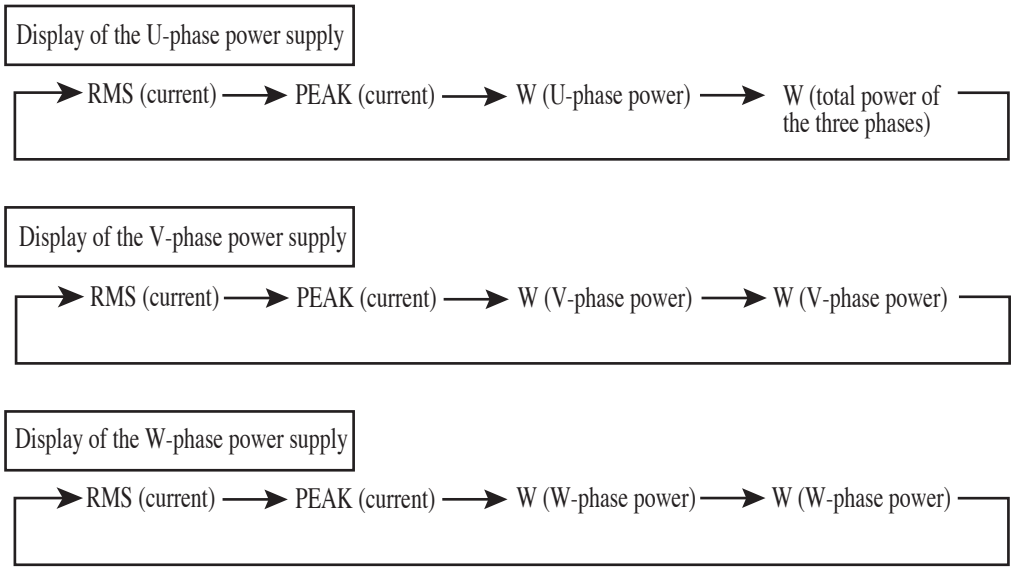
Current limit value setting

A current limit value can be set for each phase.

6.5 Current/Power Display Mode

Each time the I MODE (SHIFT, I) key is pressed, the current/power display mode changes as shown below.

If the output power exceeds 10 kW, “E3” appears at the upper left of the power display.



Indication when the output voltage exceeds 10 kW

Example: For 12000 W

"E3" stands for 10^3 (k, kilo) represented in exponential form. This example represents 12.0 x 10^3 = 12000 W.

6.6 Memory Function

- The memory function is available only in the phase voltage display mode.
- The U-phase power supply allows the voltage and frequency to be stored in the memory.
- The V- or W-phase power supply allows only the voltage to be stored in the memory.
- The voltage read from the U-phase power supply memory is set to all phases.

6.7 Key-lock Function

The key-lock function locks keying operations on the control panel. This function works singly for each phase. Even when the key-lock function is activated, the OUTPUT can be turned ON/OFF.

Key-lock procedure

1. Press the ESC key to select the Home Position.
2. Press the KEYLOCK (SHIFT, 4) key.

   This causes the PCR-LA power supply to enter the key-lock mode, and the KEY LOCK indication to light up on the control panel.
3. To cancel the key-lock mode, press the KEYLOCK (SHIFT, 4) key again.

NOTE

- The PCR-LA power supplies store the key-lock mode setting. If a PCR-LA power supply is in the key-lock mode when the SYSTEM POWER switch is turned OFF, this AC power supply also enters the key-lock mode when the SYSTEM POWER switch is turned ON next time.
- The key-lock mode is deactivated in the initial setup status.

6.8 Steps to be Taken in the Event of an Alarm

If an alarm occurs, an intermittent buzzer tone will sound and "ALARM" will light up or "Err X" (X: number) will be displayed (for an Err X display, no buzzer sounds). In such a case, the protective function relevant to the cause of the error will operate to prevent an escalation of the problem and to protect the connected load from breakage.

NOTE

- If an alarm occurs, the AC power supply always turns the output OFF.
- There may not be a problem in the power supply, depending on the alarm type. In such a case, clear the alarm and use the power supply as usual.

Operating procedure

1. Always turn the SYSTEM POWER switch OFF.

   If any step other than this is taken, the ALARM indication may be cleared, preventing checking of the alarm type.

2. Wait for more than 5 seconds after turning the SYSTEM POWER switch OFF, then turn the switch ON again.

   If no alarm occurs, the AC power supply can continue to be used.

3. 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)

The self-test function is integrally activated from the U-phase unit's control panel.

4. While "ALARM" is lit, press the SELF TEST (SHIFT, 3) key on the U-phase unit.

   This will cause "No. X" to appear in the current display area and "Ad. X" to appear in the voltage display area.

5. Turn JOG. This will cause the content of the current display area and that of the voltage display area to change. Then, read the number displayed in the "No." area when "Ad. 0" appears.

   "Ad." is the number of a power unit in the AC power supply (Table 6-1).

   Turning JOG causes the numbers in "Ad." and "No." to change, in addition to the letter "U," "V," or "W" at the left of the voltage display area. Each letter indicates that the relevant phase power supply is under self-testing.

6. Take measures corresponding to the displayed "No." in accordance with Table 6-2.

■ Alarm-clearing procedure (Alarm (8))

7. Press the ALAM CLR (SHIFT, CLR) key.

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

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

9. Check for an alarm from "Ad. 1" to the last Ad. number (the last Ad. number will differ by model) in the same way as in step 5.

   If there is no alarm, the AC power supply can continue to be used.

   If this check results in an alarm for all numbers, the power supply can no longer be used. Contact Kikusui distributor/agent.

Ad. Numbers to be displayed by SELF TEST

Table 6-1 Ad. Numbers

Ad.	Model concerned
0	All PCR-LA power supplies
1–2	PCR2000LA U-phase unit
1–4	PCR4000LA U-phase unit
1–6	PCR6000LA U-phase unit
11–12	PCR2000LA V-phase unit
11–14	PCR4000LA V-phase unit
11–16	PCR6000LA V-phase unit
21–22	PCR2000LA W-phase unit
21–24	PCR4000LA W-phase unit
21–26	PCR6000LA W-phase unit

"Ad." indicates the number of a power unit in the AC power supply. The power units are numbered sequentially from the top down.

NOTE

- Depending on the alarm type, a phase unit other than the unit in which an alarm has occurred may display an alarm number.

a) If an alarm occurs in only one of the PCR-LA power supplies:

   The alarm has occurred in the phase unit concerned.

b) If an alarm occurs in two or more of the PCR-LA power supplies:

   The alarm may have occurred in the first phase unit of these power supplies, in the order of the W-, V-, and U-phase units.

Example 1: If an alarm number is displayed in all phase units, the alarm may have occurred only in the W-phase unit.

Example 2: If an alarm number is displayed in the U- and V-phase units, the alarm may have occurred only in the V-phase unit.

Numbers in the No. area indicated by SELF TEST

Table 6-2 Err Numbers and Remedies (The section to be referred to in the Remedy column indicates the section number in the PCR-LA AC Power Supply Operation Manual.)

No.	Remedy
0	No alarm
1	The internal circuit protection has activated. **Contact Kikusui distributor/agent.**
2	The internal temperature is expected to be abnormally high. **Wait approx. 10 minutes with the power ON.** **If the alarm continues, perform the procedure specified in "2.5 Input Connections".** **If the alarm goes off, the power supply may be installed improperly. Check the description in "2.2 Precautions on Installation".** **If nothing wrong is found in either of these steps, immediately stop using the power supply and contact Kikusui distributor/agent.**
3	The internal semiconductor protective function has activated. **See "8.5 Overload Protective Functions".**
4	The internal circuit protective function has activated. **Immediately stop using the AC power supply and contact Kikusui distributor/agent.**
5	
6	The current limiting function has activated. **See "8.5 Overload Protective Functions".**
7	The sensing function has been used improperly. **See "4.5 Sensing Function".** The output voltage may become +10% or more of the set value. If the alarm cannot be cleared by correcting the use of the sensing function, **immediately stop using the power supply and contact Kikusui agent.**
8	The power unit concerned may have been removed. This alarm can be cleared to use the system. However, the output capacity will be limited due to the fact that the power unit is not functioning. **See Alarm-clearing procedure (Alarm (8)).**

NOTE • When requesting a repair, inform us of this number.

Check to be Performed if “Err X” is Displayed

If an error occurs, the control panel will continue displaying “Err X” (X: number).

Table 6-3 Err Numbers and Remedies (The section to be referred to in the Remedy column indicates the section number in the PCR-LA AC Power Supply Operation Manual.)

Err X	Remedy
1	All internal power units are defective. **Immediately stop using the AC power supply and contact Kikusui distributor/agent.**
4	An error has occurred in the AC power supply. **Turn the POWER switch OFF and wait for more than 5 seconds, then turn the switch ON with the MEM key held down. Then, perform a reset. This causes the power supply to enter the initial setup status.**
5	The input voltage is out of the rated range. **See “2.5 Input Connections”.**
Other numbers	**Contact Kikusui distributor/agent.**

6.9 Limitations on the PCR-LA Power Supplies

For the power line abnormality simulation function, some of the specifications differs from those of this function available in single-phase parallel operation. See the specification information in "8.1.3 Three-phase Operation".

In three-phase operation, the following functions cannot be used:

DC mode

AC + DC mode

Sensing function

Regulation adjustment function

Average voltage value measurement function

Average current value measurement function

6.10 Using the Remote Controller

This section describes the functions and operation methods for three-phase operation of the PCR-LA power supplies when used together with the Remote Controller (RC04-PCR-LA).

The Remote Controller is installed in the U-phase power supply.

This manual describes the procedures for the three-phase operation available functions that differ from those available when a PCR-LA AC power supply and Remote Controller are operated in a single-phase system. For information not provided in this manual, see the RC04-PCR-LA Operation Manual. Moreover, before reading this section, always read through the RC04-PCR-LA Operation Manual.

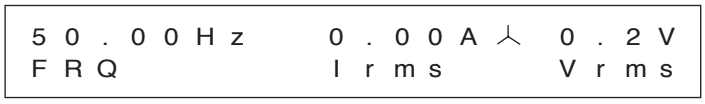
6.10.1 Switching between Phase Voltage and Line Voltage Displays

The phase voltage display and line voltage display modes are provided for three-phase operation. The display mode will be backed up, and when the POWER switch is turned ON, the display mode used immediately before the POWER switch was turned OFF will be selected.

1. Press the ESC key to select the Home Position.
2. Press the PHASE (SHIFT, 2) key.

   This procedure alternately switches between the phase voltage display and line voltage display.

Phase Voltage Display Mode



- The 人 symbol at the left of the voltage display area on the LCD indicates that the phase voltage display mode is selected.
- To switch from the phase voltage display mode to the line voltage display mode, the U-to-V phase difference must be 120 degrees and the U-to-W phase difference must be 240 degrees. Moreover, if the V- and W-phase voltages are set separately, line voltage display will not be selected.

  In such a case, vary it to the same value through the U-phase power supply control panel. This allows selection of the line voltage display mode.

Line Voltage Display Mode

```
50.00Hz      0.00A △  0.2V
FRQ          Irms     Vrms
```

- The △ symbol at the left of the voltage display area on the LCD indicates that the line voltage display mode is selected.
- Setting the voltage in the line voltage display mode allows line voltage setting.
- In the line voltage display mode, the U-to-V or U-to-W phase difference cannot be modified.
- The line voltage display mode disables measurement of output power.
- In the line voltage display mode, the V- or W-phase voltage cannot be set separately.

6.10.2 Setting the U-to-V or U-to-W Phase Difference

1. Press the ESC key to select the Home Position.
2. Press the MODE key.

```
FREE           0 Ω
PHASE        IMP
```

F1 F2 F3 F4 F5

3. Press the F1 (PHASE) key to select the phase setting mode.

```
PHASE      FREE       FREE
        OUT_ON     OUT_OFF
```

F1 F2 F3 F4 F5

4. Press the MENU key to select the U-to-V or U-to-W phase-difference setting mode.

```
PHASE    120deg   240deg
           U_V        U_W
```

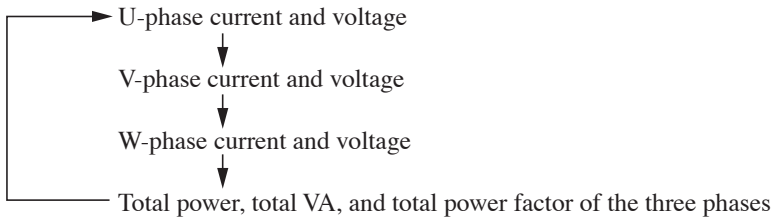
F1 F2 F3 F4 F5

5. Press the F3 (U_V) or F5 (U_W) key to select a phase difference of U-to-V or U-to-W.
6. Use the numeric keys or JOG/SHUTTLE to set the phase difference.
7. Press the ESC key to exit the phase-difference setting mode.

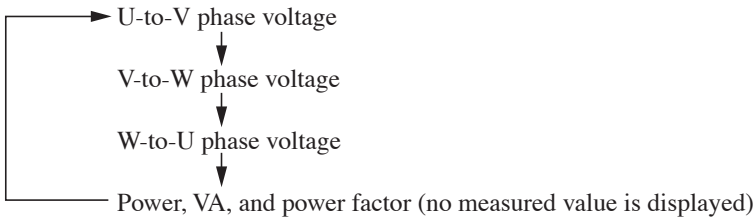
6.10.3 Displaying the V- or W-Phase Current and Voltage and the V-to-W or W-to-U Line Voltage

1. Press the ESC key to select the Home Position.
2. Press the MENU key. Each time this key is pressed, the display changes as follows.

   For the phase voltage display mode:

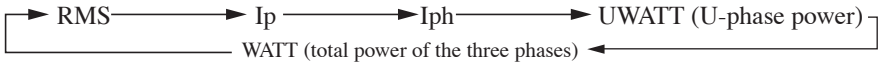


   For the line voltage display mode:



6.10.4 Switching to the Current or Power Display Mode

Each time the SHIFT key is pressed followed by the F3 key in the Home Position, the current and power display mode changes as follows:



6.10.5 Sequence Operation

In the sequence setting mode, items available in the DC or AC + DC mode cannot be set. In addition, AC voltage (Vac) applies phase voltage setting.

6.10.6 Harmonic Current Analysis Function

The Remote Controller (RC04-PCR-LA) connected to the U-phase power supply allows harmonics in a load current to be analyzed in each of the U, V, and W phases.

For this operation, add the following step between steps 2 and 3 in “4.4.3 Harmonic Current Analysis Function” in the RC04-PCR-LA Operation Manual.

2a. Select the phase that performs harmonic current analysis.

- Pressing the F1 key selects phase U, pressing the F3 key selects phase V, and pressing the F5 key selects phase W.

Thereafter, follow the procedure from step 3 onward as specified in "4.4.3 Harmonic Current Analysis Function" in the RC04-PCR-LA Operation Manual.

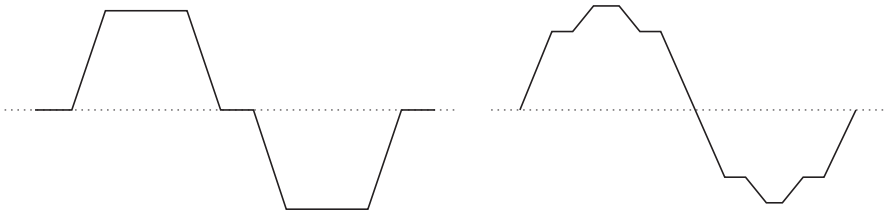
- The letter "U," "V," or "W," indicating the selected phase, appears at the left of the first component of the harmonic current analysis result indicated on the display.

6.10.7 Special Waveform Output Function

Use of the Remote Controller (RC04-PCR-LA) allows output of the peak-clipped waveform of the line voltage. However, be aware that the line voltage waveform becomes as shown below.

The setting range is 1.25 to 1.40.

If a value outside this setting range is set, no waveform will be output.



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" indicates neutral.

Fig. 6-1 Peak-clipped Waveform

DESCRIPTION

- A general three-phase capacitor input-type rectifier circuit is as shown in Fig. 6-2. A current flows at 60-degree and 120-degree phases of the voltage waveform. Thus, the voltage waveform becomes as shown in Fig. 6-1.

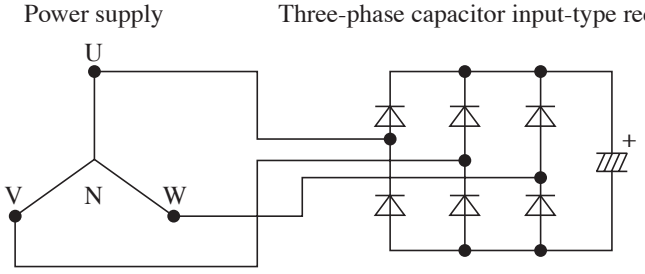


Fig. 6-2 Three-phase Capacitor Input-type Rectifier Circuit

6.11 Using the GPIB/RS-232C Interface

This section describes the functions and messages available when the 3-phase Output Driver and GPIB Interface (IB03-PCR-LA) or RS-232C Interface are used in combination for three-phase operation of the PCR-LA power supplies.

When operating the three-phase system PCR-LA AC power supplies using the GPIB or RS-232C feature, use the GPIB Interface installed in or the RS-232C Interface provided for the U-phase AC power supply.

This section describes the functions available in three-phase operation that differ from those available when a PCR-LA AC power supply and GPIB Interface or RS-232C Interface are operated in a single-phase system. For information not provided in this manual, see the PCR-LA AC Power Supply Operation Manual. Moreover, before reading the 3P03-PCR-LA Operation Manual, be sure to read through the PCR-LA AC Power Supply Operation Manual.

6.11.1 Phase Voltage/Line Voltage Display Messages

The phase voltage and line voltage display modes for display are provided for three-phase operation. The display mode will be backed up and, when the POWER switch is turned ON, the display mode used immediately before the POWER switch was turned OFF will be selected.

VPHASE

Switches the voltage value display method to the phase voltage display mode.

Phase voltage setting is available in the phase voltage display mode.

Measurements of the power, apparent power, and power factor can be performed in the phase voltage display mode.

Program message

- Syntax
  Command message: `VPHASE`

VLINE

Switches the voltage value display method to the line voltage display mode.

Line voltage setting is available in the line voltage display mode.

Program message

- Syntax
  Command message: `VLINE`

6.11.2 Phase-difference Setting Messages

PHASEV

Sets or inquires about a U-to-V phase difference.

This message is enabled in the phase voltage display mode.

If data other than the initial set values have been set to the U-to-V or U-to-W phase difference, the line voltage display mode cannot be selected.

Program message

- Syntax
  Command message: `PHASEV <NR1>`
  Query message: `PHASEV?`
- Program data
  Data format: Integer
  Set value: 0 to 360
  Initial value: 120 (setting at factory shipment)

(Example) To set the U-to-V phase difference to 125 degrees

```
PHASEV 125
```

Response message

Returns the U-to-V phase-difference set value in response to PHASEV?

PHASEW

Sets or inquires about a U-to-W phase difference.

This message is enabled in the phase voltage display mode.

If data other than the initial set values have been set to the U-to-V or U-to-W phase difference, the line voltage display mode cannot be selected.

Program message

- Syntax
  Command message: `PHASEW <NR1>`
  Query message: `PHASEW?`
- Program data
  Data format: Integer
  Set value: 0 to 360
  Initial value: 240 (setting at factory shipment)

(Example) To set the U-to-W phase difference to 238 degrees

```
PHASEW 238
```

Response message

Returns the U-to-W phase-difference set value in response to PHASEW?

6.11.3 Output Voltage Setting Messages

VSET/ACVSET

Sets or inquires about the phase voltage.
The VSET message and ACVSET message function in the same way.
In output voltage setting, all phase voltages are set to the same value.
These messages are enabled in the phase voltage display mode.

Program message

- Syntax
  Command message: `VSET <NR2>`
  `ACVSET <NR2>`
  Query message: `VSET?`
  `ACVSET?`
- Program data
  Same as that of single-phase operation

Response message

Returns a phase voltage set value in response to VSET?/ACVSET?

LINEVSET

Sets or inquires about the line voltage.
This message is enabled in the line voltage display mode.

Program message

- Syntax
  Command message: `LINEVSET <NR2>`
  Query message: `LINEVSET?`
- Program data
  1.73 times the voltage set by the VSET/ACVSET message can be set.

Response message

Returns a line voltage set value in response to LINEVSET?

UVSET

Sets or inquires about the U-phase voltage.
This message is enabled in the phase voltage display mode.

Program message

- Syntax
  Command message: `UVSET <NR2>`
  Query message: `UVSET?`

• Program data

Same as that of the VSET/ACVSET message

Response message

Returns a U-phase voltage set value in response to UVSET?

VVSET

Sets or inquires about the V-phase voltage.

This message is enabled in the phase voltage display mode.

Program message

• Syntax

Command message: `VVSET <NR2>`

Query message: `VVSET?`

• Program data

Same as that of the VSET/ACVSET message

Response message

Returns a V-phase voltage set value in response to VVSET?

WVSET

Sets or inquires about the W-phase voltage.

This message is enabled in the phase voltage display mode.

Program message

• Syntax

Command message: `WVSET <NR2>`

Query message: `WVSET?`

• Program data

Same as that of the VSET/ACVSET message

Response message

Returns a W-phase voltage set value in response to WVSET?

6.11.4 Output Measurement Messages

VOUT?

Inquires about a measured voltage value

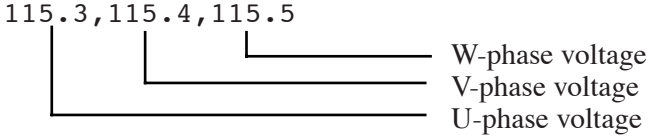
Program message

- Syntax
  Query message: `VOUT?`

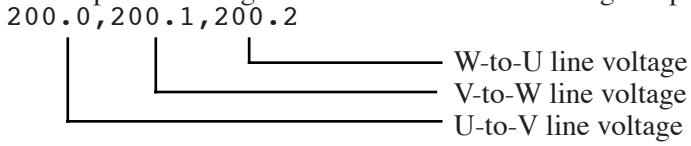
Response message

Returns U-, V-, and W-phase voltages, delimited by a comma (,), in the phase voltage display mode; returns U-V, V-W, and W-V voltages, delimited by a comma (,), in the line voltage display mode

Example: A response message for VOUT? in the phase voltage display mode is



Example: A response message for VOUT? in the line voltage display mode is



IOUT?

Inquires about a measured current value

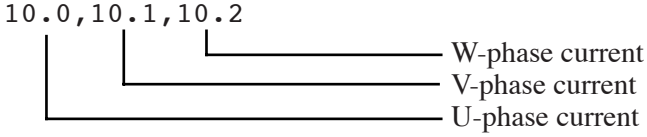
Program message

- Syntax
  Query message: `IOUT?`

Response message

Returns U-, V-, and W-phase currents, delimited by a comma (,)

Example: A response message for IOUT? is



WATT?

Inquires about a measured power value.

This message is enabled in the phase voltage display mode.

Program message

• Syntax
Query message: `WATT?`

Response message

Returns the U-, V-, and W-phase power values and the total power, delimited by a comma (,)

Example: A response message for WATT? is

```
200.0,200.1,200.2,600.3
```

PF?

Inquires about a measured power factor.

This message is enabled in the phase voltage display mode.

Program message

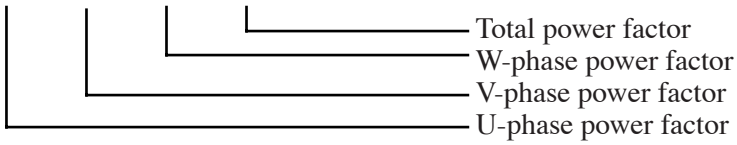
• Syntax
Query message: `PF?`

Response message

Returns U-, V-, and W-phase power factors and the total power factor, delimited by a comma (,)

Example: A response message for PF? is

```
0.60,0.62,0.64,0.62
```



The total power factor is obtained by PFtotal = Wtotal / VAtotal.

VA?

Inquires about a measured apparent power value.

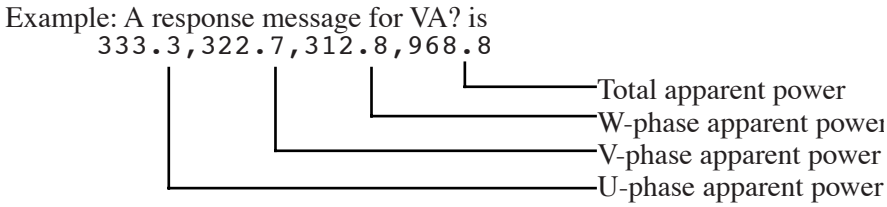
This message is enabled in the phase voltage display mode.

Program message

• Syntax
Query message: `VA?`

Response message

Returns U-, V-, and W-phase apparent power values and the total apparent power, delimited by a comma (,)



6.11.5 Harmonic Current Analysis Messages

Harmonic current analysis can be conducted in the same way as in single-phase operation. However, it is necessary to use a message corresponding to the relevant phase to read out analyzed data in each phase.

This section briefly describes the messages for each phase, and shows the syntax only. The data format and set value of the program data on each message and its response message are the same as those applied in single-phase operation. For more information on these, see "9.4.4 Harmonic Current Analysis" of the PCR-LA AC Power Supply Operation Manual.

UCURHARMA?

Inquires about the value representing the harmonics component (in current) of each degree in the U-phase

Program message

- Syntax
  Query message: `UCURHARMA {<NR1>|ODD|EVEN|LOW|HIGH}?`

VCURHARMA?

Inquires about the value representing the harmonics component (in current) of each degree in the V-phase

Program message

- Syntax
  Query message: `VCURHARMA {<NR1>|ODD|EVEN|LOW|HIGH}?`

WCURHARMA?

Inquires about the value representing the harmonics component (in current) of each degree in the W-phase

Program message

- Syntax
  Query message: `WCURHARMA {<NR1>|ODD|EVEN|LOW|HIGH}?`

UCURHARMP?

Inquires about the percentage of a harmonic current value in the U-phase, obtained by regarding the current value of the basic wave component as 100%

Program message

- Syntax
  Query message: `UCURHARMP {<NR1>|ODD|EVEN|LOW|HIGH}?`

VCURHARMP?

Inquires about the percentage of a harmonic current value in the V-phase, obtained by regarding the current value of the basic wave component as 100%

Program message

- Syntax
  Query message: `VCURHARMP {<NR1>|ODD|EVEN|LOW|HIGH}?`

WCURHARMP?

Inquires about the percentage of a harmonic current value in the W-phase, obtained by regarding the current value of the basic wave component as 100%

Program message

- Syntax
  Query message: `WCURHARMP {<NR1>|ODD|EVEN|LOW|HIGH}?`

Chapter 7 Maintenance

Describes the maintenance procedure for the system, including the PCR-LA AC power supplies. Also explains the remedies against possible malfunctions encountered during use of the system.

7.1 Maintenance

⚠ WARNING • There is a possibility of electric shock, which could result in physical injury or death. Always turn OFF the POWER switch, then turn OFF the switch on the switchboard.

7.1.1 Cleaning the Panel Surface

If the panel becomes soiled, wet a piece of soft cloth with a water-diluted neutral detergent, and wipe the panel gently.

⚠ CAUTION • Do not use volatile solvents such as thinner or benzine, as they may discolor the unit surface coating, erase printed characters, or make the face of the display unit opaque.

7.1.2 Cleaning the Air-intake Filters in the PCR-LA Power Supplies

The inside of the louver on the front panel of a PCR-LA power supply is equipped with air-intake filters. Clean these filters periodically before they become extremely clogged. For more information on the cleaning procedure, see the PCR-LA AC Power Supply Operation Manual.

⚠ CAUTION • If an air-intake filter becomes clogged, the internal cooling effects of a PCR-LA power supply are degraded, which may cause a problem or shorten the life of the power supply.

7.1.3 Inspecting the Power Connection Cables

Check the power connection cables for external damage. In addition, check to confirm that no connection terminal screw has become loose.

7.2 Malfunctions and Causes

This section describes some symptoms of possible malfunctions encountered during use of the system, along with appropriate remedies. The symptoms of possible malfunctions and remedies described here apply to single-phase parallel operation or three-phase operation.

For the symptoms of possible malfunctions and appropriate remedies for a PCR-LA power supply, see the PCR-LA AC Power Supply Operation Manual.

In this section, we describe seven typical symptoms and possible check items for each; you simply find the relevant item.

When the relevant item is found, take the corresponding remedy. If this does not solve or improve the problem, or if no relevant item can be located, contact Kikusui distributor/agent.

7.2.1 Single-phase Parallel Operation

Symptom1: The PCR-LA power supply display panel displays "Err2" or nothing, or continues to display the version number.

Check item		Possible cause	Remedy
Location and condition of the item concerned	Check results		
Check whether the master/slave cards are properly inserted into the correct slot.	No	Improper card installation	Insert the card(s) into the correct slot(s). "2.5.4 Parallel Operation Driver".
Check whether the drive-signal cables are properly connected.	No	Improper drive-signal cable connection(s)	Connect the cables securely between the master and slave units, and between the slave-1 and slave-2 units. See "2.5.4 Parallel Operation Driver".
Check whether the DIP switches (parallel operation address) of each card have been properly set.	No	Incorrect parallel operation address setting, which disables single-phase parallel operation	Set the correct parallel operation addresses. See "2.5.4 Parallel Operation Driver".

Symptom2: An ALARM indication appears or the output voltage is not generated as set.

Check item		Possible cause	Remedy
Location and condition of the item concerned	Check results		
Check whether the signal connection cables have been properly connected.	No	Improper connection of signal connection cables. If any signal connection cable is not properly connected, single-phase parallel operation does not function properly and a problem may be caused.	Use and connect the supplied signal connection cables properly. See “2.5.3 Signal Connection Cables”.

Symptom3: The SYSTEM POWER switch does not turn ON.

Check item		Possible cause	Remedy
Location and condition of the item concerned	Check results		
Check whether all of the PCR-LA power supplies’ POWER switches are ON.	No	One or more of the PCR-LA power supplies’ POWER switches has not been turned ON.	Turn ON all of the PCR-LA power supplies’ POWER switches, followed by the Output Terminal’s SYSTEM POWER switch.

7.2.2 Three-phase Operation

Symptom1: The PCR-LA power supply display panel displays "Err2" or nothing, or continues to display the version number.

Check item		Possible cause	Remedy
Location and condition of the item concerned	Check results		
Check whether the three phase cards are properly inserted into the correct slot.	No	Improper phase-card installation	Insert the card(s) into the correct slot(s). See "2.5.5 3-phase Output Driver".
Check whether the drive-signal cables are properly connected.	No	Improper drive-signal cable connection	Securely connect the cables between the master and slave units, and between the slave-1 and slave-2 units. See "2.5.5 3-phase Output Driver".

Symptom2: The rated output cannot be generated.

Check item		Possible cause	Remedy
Location and condition of the item concerned	Check results		
Check whether the output neutral point is connected to a load (three-phase, four-wire system).	No	A load is connected in a three-phase, three-wire system (delta connection). In delta connection, the presence of unbalance between three-phase currents may disable the generation of rated output.	Connect the output neutral point to the load (three-phase, four-wire system).

Symptom3: A voltage different from the set voltage is generated ($\sqrt{3}$ times or 1/$\sqrt{3}$).

Check item		Possible cause	Remedy
Location and condition of the item concerned	Check results		
Different voltage display mode.	No	The phase voltage display mode sets the phase voltage, while the line voltage display mode sets the line voltage.	Select the correct voltage display mode. See “6.2 Switching of Output Voltage Display”.

Symptom4: The voltage display becomes abnormal in the line voltage display mode.

Check item		Possible cause	Remedy
Location and condition of the item concerned	Check results		
Check whether the SENSING terminal boards are properly connected.	No	Improper cable connection to the SENSING terminal board, which disables line voltage measurement	Connect the signal connection cables to the SENSING terminal boards properly. See “2.5.3 Signal Connection Cables”.

Chapter 8 Specifications

Shows the specifications and accessories for the Output Expansion Kits.

8.1 Specifications

8.1.1 Output Expansion Kits (Single-phase/Three-phase Switching)

Output terminal section

Model name		OT01-PCR6000LA/3	OT01-PCR12000LA/3	OT01-PCR18000LA/3
Maximum output current	Single-phase output	60 A	120 A	180 A
	Three-phase output	20 A	40 A	60 A
Output terminal board connection screws	Single-phase output	M6	M8	M10
	Three-phase output	M6		
Insulation resistance: Input to chassis, output to chassis		500 V DC, 3 MΩ or more		
Withstand voltage: Input to chassis, output to chassis		1500 V AC for one minute		
External dimensions (chassis)		430 mm x 84 mm x 400 mm	430 mm x 218 mm x 400 mm	430 mm x 218 mm x 400 mm
Weight		Approx. 7 kg	Approx. 17 kg	Approx. 18 kg
Operating ambient temperature/humidity		0 °C to +40 °C/20 % to 80 % RH (no condensation allowed)		

Driver cards and cables

Three-phase Output Driver	A set of 3P03-OT01-PCR-LA (specially designed for the OT01 series)		
Parallel Operation Driver (for the master unit)	A set of PD03M-OT01-PCR-LA (specially designed for the OT01 series)		
Parallel Operation Driver (for the slave units)	A set of PD03S-OT01-PCR-LA (specially designed for the OT01 series)		
Power connection cables	5.5 mm^2/2.5 m, 9 cables	8 mm^2/2.5 m, 9 cables	14 mm^2/2.5 m, 9 cables
Signal connection cables	With a connector at both ends, 8 cables		
Operation Manual	One copy		

8.1.2 Parallel Operation

Output voltage stability, waveform distortion ratio, response rate

Output current variation (with respect to 0 % to 100 % changes in rating)		Within ± 1 V (*1) (*2)
Output frequency variation	AC mode (with respect to changes in the rated range)	Within ± 1.2 % (*1) (*3)
Output voltage waveform distortion ratio (*10)		0.5 % or less (*1) (*2)
Output voltage response rate (*11)		60 μs (typical value) (*4)
Ammeter and wattmeter		Total values for parallel operation (*5)

The above table shows the comprehensive capability achieved when the PCR-LA AC power supplies are operated in parallel. The remaining specifications comply with those for a PCR-LA AC power supply.

(*1) The value measured at the OUTPUT terminal board of the master unit

(*2) For output voltage of 80 V to 150 V/160 V to 300 V and a load power factor of 1

(*3) For output voltage of 80 V to 150 V/160 V to 300 V and a load power factor of 1. The value specified is the output-voltage variation obtained using 200 Hz as a reference.

(*4) With respect to changes from an output current of 0 A to the rating and vice versa when the output voltage range is 100 V/200 V and the load power factor is 1

(*5) The resolution changes in accordance with the output capacity achieved during parallel operation. The accuracy is the same as that of the PCR-LA AC power supply when the zero calibration function is performed.

8.1.3 Three-phase Operation

Output phase voltage's phase difference

Output voltage phase difference (*6)	Within 120° ± (0.4° + 5μs) Within 120° ± (0.4° + f_0 x 1.8 x 10^{-3}°). "f_0" stands for the output frequency. (*7)

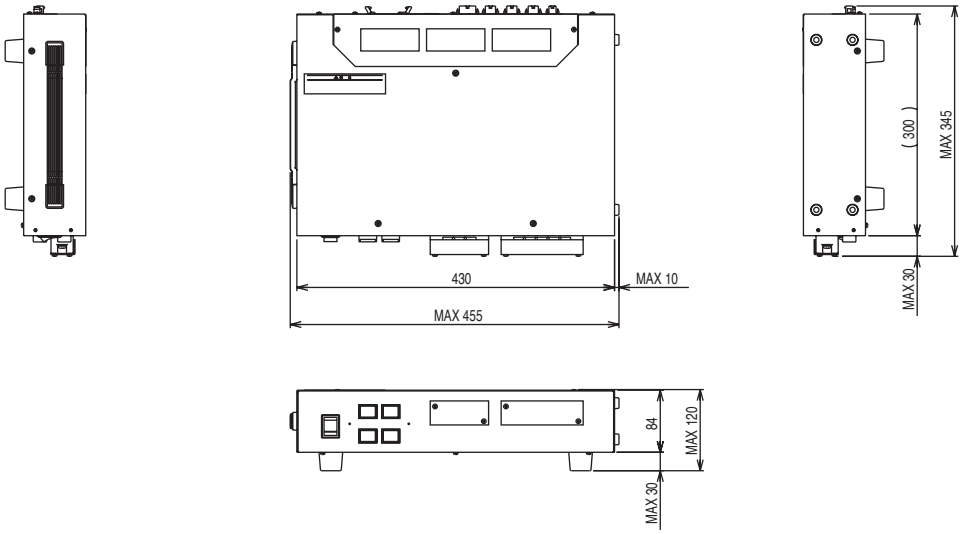
(*6) Phase difference between output voltages (phase voltages) when each phase is seen from the neutral point in the condition in which the phase difference is not varied (phase difference between each phase: 120°)

(*7) The following are examples of the results obtained through angular conversion of the noted expression at specific frequencies:
Within 120° ± 0.5° (for 60-Hz output)
Within 120° ± 1.2° (for 400-Hz output)

Power line abnormality simulation
(specifications different from those achieved in single-phase parallel operation.)

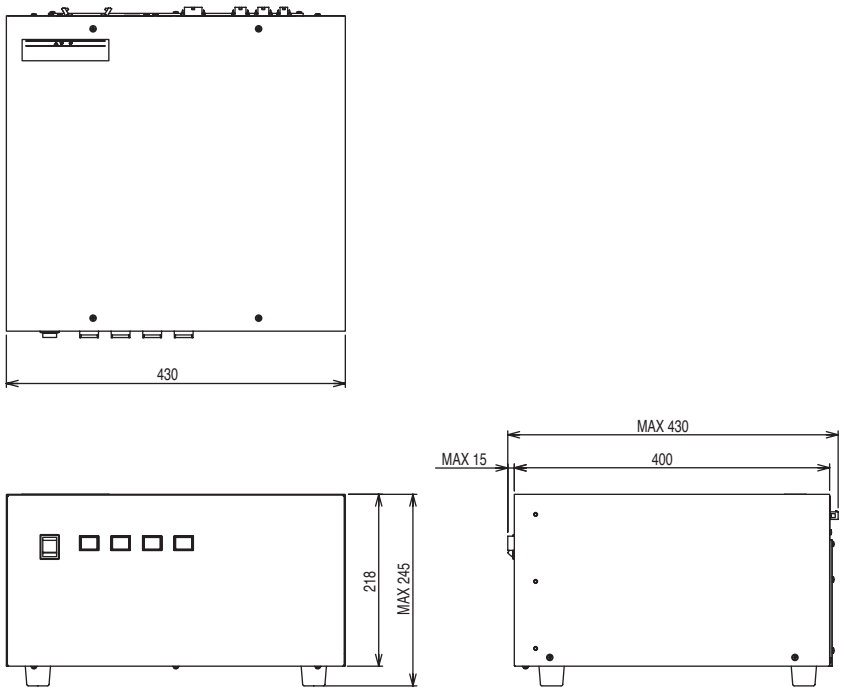
Item		Setting rangec	Resolutiond	Setting accuracy
T1	x 1deg	0 deg – 360 deg	1 deg	± 1.5 ms
	x 1ms	0 ms – 999 ms	1 ms	± 1 ms
T3	x 1	0 ms – 9999 ms	1 ms	± (0.1 %+1 ms)
V(T3)		0 V to rated voltage (phase voltage setting)		—

8.2 Dimensions



Unit: mm

Fig. 8-1 Output Terminal OT01-PCR6000LA/3



Unit: mm

Fig. 8-2 Output Terminal OT01-PCR12000LA/3 or OT01-PCR18000LA/3

Index

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