

# OPERATION MANUAL

3-PHASE DRIVER

3P02-PCR-L



Part No. Z1-000-392, 1A001762

The specifications of this product and the contents of this Operation Manual are subject to change without prior notice.

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This manual applies to the 3P02-PCR-L 3-Phase Driver connected to a PCR-L AC Power Supply with ROM version 2.00 or higher. When you inquire about the product, be prepared to provide us with the following information:

- PCR-L AC Power Supply model number
- PCR-L AC Power Supply ROM version
- PCR-L AC Power Supply serial number and revision number (indicated on the lower rear part of the equipment)
- 3-Phase Driver model number
- 3-Phase Driver serial number and revision number

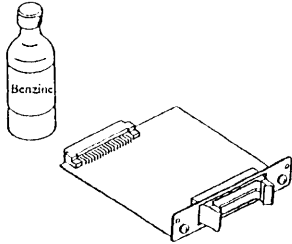
\* Before using this 3-Phase Driver, be sure to read the PCR-L AC Power Supply Operation Manual.

This device is a dedicated option for the PCR-L Series. It cannot be used for any other equipment.

A PCR-L AC Power Supply with ROM version below 2.00 requires partial modification.

## FOR SAFETY USE




Always observe the following warnings and precautions when handling or using the 3-Phase Driver.



- Take proper precautions against explosion or fire.
  - Do not use the device in an explosive atmosphere or near flammable substances.
  
- Do not use substitute components or otherwise modify the device.
  - The device uses no parts that can be replaced by the customer.
  
- Ensure safety first in the events of a problem.
  - If the device is damaged or becomes defective, immediately disconnect the PCR-L AC Power Supply input plug from the electrical outlet or cut off power from the power distribution board.
  - Take appropriate measures to ensure that the device will not be used by mistake until repair has been completed.

## Warning and Precaution Symbols Indicated on the 3-Phase Driver and in the Operation Manual.

The following symbols are indicated where special caution is required in handling the device.

3-Phase Driver	Operation manual	Description
		<p>Indicates the existence of a personnel hazard.</p> <ul style="list-style-type: none"> <li>• Never fail to follow the applicable operating procedure.</li> </ul> <p>Incorrect operating procedures may result in personal (bodily) injury.</p> <ul style="list-style-type: none"> <li>• Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.</li> </ul>
		<p>Indicates the existence of a hazard.</p> <ul style="list-style-type: none"> <li>• Always follow the applicable operating procedure.</li> </ul> <p>Incorrect operating procedures may damage the device or other equipment.</p> <ul style="list-style-type: none"> <li>• Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.</li> </ul>
		<p>Operation manual reference symbol</p> <ul style="list-style-type: none"> <li>• If this mark is indicated on the device, see the relevant section of this Operation Manual.</li> </ul>



## CONFIGURATION OF THE OPERATION MANUAL

This operation manual is structured as follows:

Chapter 1. GENERAL	Describes the basics of the 3-Phase Driver use. Be sure to read this information.
Chapter 2. PREPARATION	
Chapter 3. CABLE CONNECTION	
Chapter 4. OPERATION CHECK	
Chapter 5. OPERATION METHOD	Describes the basic operating procedures.
Chapter 6. USING THE REMOTE CONTROLLER	
Chapter 7. USING THE GP-IB/RS-232C INTERFACE	
Chapter 8. PART NAMES	Describes the part names and their functions in detail.
Chapter 9. MAINTENANCE	Describes how to handle the 3-Phase Driver in the event of a problem. Always read this chapter before requesting a repair.
Chapter 10. SPECIFICATIONS	
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# Chapter 1

## GENERAL

Describes the 3-Phase Driver overview and features.

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## 1.1 Outline

This device (3P02-PCR-L) is an option for three-phase operation for the PCR-L Series AC Power Supplies. Connecting outputs of three PCR-L Series AC Power Supplies in star connection and installing the 3-Phase Driver in these power supplies allows the equipment to be used as three-phase power supply.

## 1.2 Features

Using the 3P02-PCR-L allows the PCR-L AC Power Supplies to utilize the following enhanced functions in addition to the PCR-L Power Supply's standard functions.

### (1) Three-phase output

Handling the U-phase equipment of three PCR-L Series AC Power Supplies as a master and the V- and W-phase equipment as slaves, these three AC power supplies can generate three- phase output.

### (2) Either line voltage or phase voltage is settable.

Three PCR-L AC Power Supplies are arranged in Y-connection (star connection); output is generally set in phase voltage. However, line voltage setting is also available.

### (3) Independent phase voltage setting

Phase voltage is generally set to all phase collectively. However, individual phase voltage setting is available on a phase basis.

### (4) Line voltage measurement

Connecting the SENSING terminal board at the bottom rear of PCR-L Series AC Power Supplies to a line voltage measurement point allows line voltage to be measured.

### (5) Measurement of total power, total apparent power, and total power factor of three phases

Total power and total apparent power obtained by measurement using three PCR-L Series AC Power Supplies can be displayed. The total power factor of three phases can also be calculated based on the noted total power and total apparent power. (Measurement of apparent power or power factor requires one of the RC02-PCR-L, IB11-PCR-L, or RS11-PCR-L option.)

### (6) Variable phase difference

Three-phase output generates waveform in which each phase is generally shifted by 120 degrees. However, the 3-Phase Driver allows this phase difference to be flexibly set. (This function requires one of options RC02-PCR-L, IB11-PCR-L, and RS11-PCR-L.)

# Chapter 2

## PREPARATION

Describes the preparation required for using the 3-Phase Driver.

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## 2.1 Check at Unpacking

The 3P02-PCR-L 3-Phase Driver was carefully tested and inspected, both mechanically and electrically, before shipment to ensure its normal operation. Check the 3-Phase Driver upon receipt for damage that might have occurred during transportation. Also, check if all items listed in the table below have been provided. If the device appears to be damaged or if any accessory missing, notify your Kikusui agent.

Items to be checked at unpacking

Items	Q'ty	Check
U-phase card	1	
V-phase card	1	
W-phase card	1	
Drive signal cable	2	
Mounting screws (M3)	6	
Operation Manual	1	

- The U-, V-, and W-phase cards have indications U, V, and W on the panel part of the cards, respectively.

## 2.2 3-Phase Driver Handling Precautions

The 3-Phase Driver (3P02-PCR-L) consists of the U-, V-, and W-phase cards and drive signal cables used to connect these cards. Observe the following handling precautions for these items.

### (1) Handling of U-, V-, and W-phase cards

Always observe the following cautions when handling each phase card since its PCB is exposed.

#### Caution

- *Never touch any of electronics parts installed on the PCB.*
- *Never handle the card under the conditions where static electricity might accumulate.*
- *After unpacking the 3-Phase Driver carton, install each phase card in a PCR-L AC Power Supply promptly.*
- *When storing the phase cards, always take measures to prevent static electricity such as storing it in the bag used for the packing.*
- *Do not drop a card or subject it to other impact.*
- *Do not place a card where it could be exposed to water and other liquid.*

### (2) Handling of drive signal cables

#### Caution

- *Do not damage the cables.*
- *Do not pull, bend, or apply any other stress on the cables.*

## 2.3 Functional Restrictions during Three-Phase Operation

Use of the 3-phase driver allows PCR-L Series AC Power Supplies to generate three-phase output. However, this restricts the AC power supply functions partially. The following functions are not available when the 3-Phase Driver is installed.

- DC mode
- AC + DC mode
- Sensing
- Regulation adjustment
- Average voltage value measurement
- Average current value measurement
- Power line abnormality simulation
- Current limit value setting

## 2.4 Combination with Other Options

The PCR-L Series has various options in addition to the 3-Phase Driver. Note that the following options can be used only in the PCR-L Series AC Power Supply where the U-phase card has been installed.

Option name	Model number
Remote controller	RC02-PCR-L
GP-IB Interface	IB11-PCR-L
RS-232C Interface	RS11-PCR-L

# Chapter 3

## CABLE CONNECTION

Describes the installation of the 3-Phase Driver in PCR-L Series AC Power Supplies and the connection of the AC power supplies.

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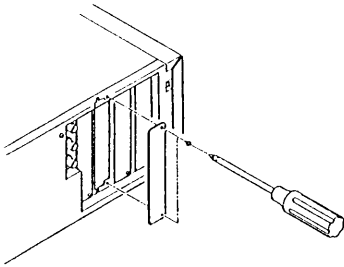


### 3.1 3-Phase Driver Installation Method

The 3-Phase Driver can be installed by inserting the U-, V-, and W-phase cards into SLOT4 or SLOT5 of three PCR-L AC Power Supplies respectively.

The PCR-L AC Power Supply with the U-phase card plays a role of the master equipment that controls the other two power supplies. It is recommended that the PCR-L AC Power Supply with the U-phase card be installed where it can be easily accessible for operation.

#### 3.1.1 Installing Phase Cards into a Slot



**Caution** Before installing a phase card into a slot, always turn OFF the PCR-L AC Power Supply POWER switch.

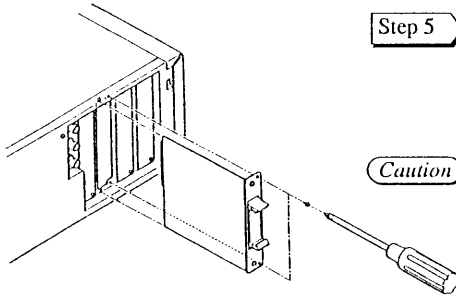
**Step 1** Unscrew the screws that fasten the SLOT4 or SLOT5 cover to remove the slot cover. (Keep the removed cover so that it is not lost.)

**Step 2** Hold the panel part of a phase card.

**Step 3** Orient the phase card so that the parts-mounted side of the PCB is at the right, and place the PCB into the slot grooves.

**Step 4** Carefully insert the card into the slot so that the PCB does not come out of the grooves.

**Step 5** Insert the card all the way, then fix the card to the PCR-L AC Power Supply using the screws provided. This completes installation of a phase card. Install the other two phase cards in this way.



**Caution** When a 3-Phase Driver card has been inserted in a PCR-L AC Power Supply's slot, such the AC power supply is used only in three-phase. To use the equipment in a single phase, the phase card must be extracted from the slot.

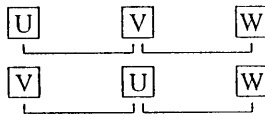
### 3.1.2 Connecting the Drive Signal Cables

**Caution** Before connecting a drive signal cable, always turn OFF the PCR-L AC Power Supply POWER switches.

**Step 1** Arrange three PCR-L AC Power Supplies as near as possible. A PCR-L Power Supply with the U-phase card plays a role of the master equipment that controls the other two power supplies. It is recommended that the PCR-L AC Power Supply with the U-phase card be installed where it can be easily accessible for operation.

**Step 2** Using two drive signal cables, connect the U-, V-, and W-phase cards in accordance with steps 3 and onward. This requires no connection order between phases U, V, and W.

Example:



Either of two examples above allows the same operation.

**Step 3** Open the click of the J1 connectors of the U-, V-, and W-phase cards, orient the connector of a drive signal cable, and insert it to a J1 connector. A J1 connector has two connection ports; either connection operates the same. Two drive signal cables are connected to the J1 connector of the phase card in the PCR-L AC Power Supply located at the center of the three AC power supplies. This uses both two connection ports of the J1 connector.

**Step 4** Close the J1 connector clicks to lock the connectors. This completes the connection of the drive signal cables.

### 3.1.3 Moving Precautions

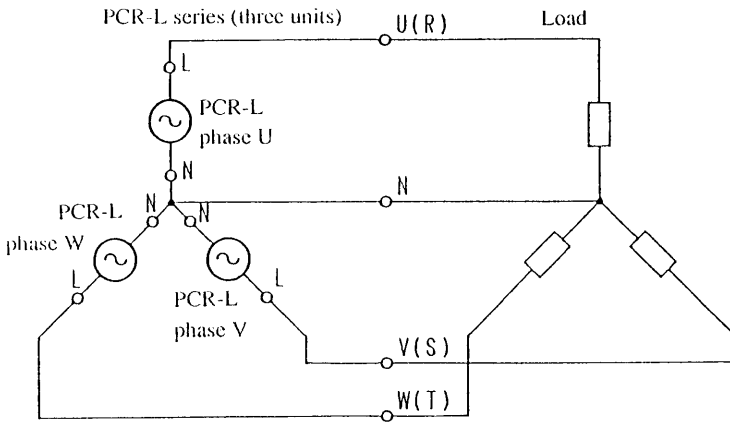
**Caution** Moving a PCR-L AC Power Supply with a drive signal cable connected to a phase card may place unreasonable stress on the drive signal cable and phase card. This may damage the 3-Phase Driver. Before moving a PCR-L AC Power Supply, always disconnect the drive signal cables.

### 3.2 PCR-L AC Power Supply Connection Method

This section describes how to connect three PCR-L AC Power Supplies for three-phase output. For the input and output connection method, always read Chapter 3, CONNECTING THE INPUT POWER, and Chapter 5, CONNECTING A LOAD, of the PCR-L Series AC Power Supply Operation Manual.

#### 3.2.1 Connecting the OUTPUT Terminal Board

Generation of three-phase output using three PCR-L Series AC Power Supplies requires that three PCR-L AC Power Supply outputs be connected in three-phase four-wire system (Y-connection, star connection) with neutral. The neutral point must always be connected to terminals N of the OUTPUT terminal boards in the PCR-L AC Power Supplies.

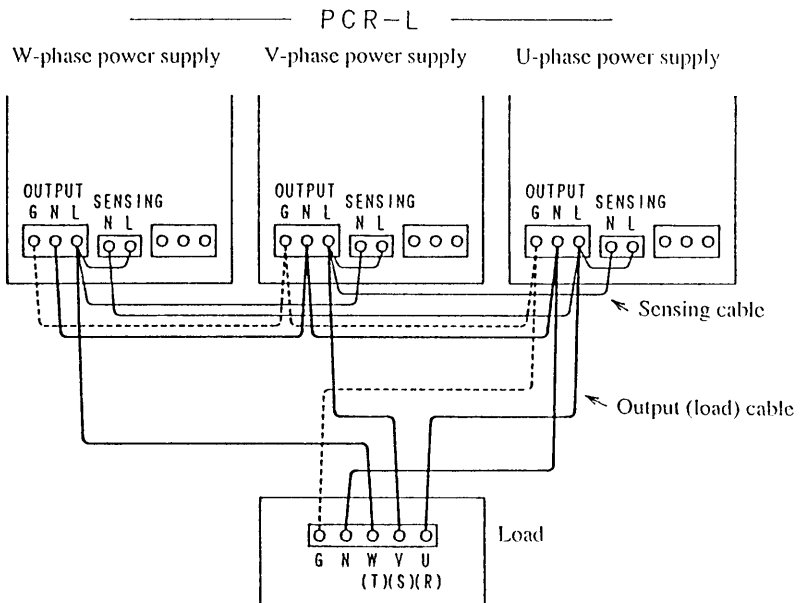


- Caution**
- Omission of the neutral point may disables generation of rated power.
  - Connecting PCR-L AC Power Supplies in delta system may cause malfunction or problem.

### 3.2.2 Connecting the SENSING Terminal Board

The SENSING terminal boards are used to measure line voltage. Line voltage measurement requires connection of the SENSING and OUTPUT terminal boards as follows:

SENSING board	OUTPUT board to be connected
L of U-phase power supply	L of U-phase power supply
N of U-phase power supply	L of V-phase power supply
L of V-phase power supply	L of V-phase power supply
N of V-phase power supply	L of W-phase power supply
L of W-phase power supply	L of W-phase power supply
N of W-phase power supply	L of U-phase power supply



# Chapter 4

## OPERATION CHECK

Describes the operation check to be conducted before operating the 3-Phase Driver.

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Description		

After completing connection of the input power cables and outputs by making preparation through chapter 3, conduct operation check as described in this chapter.

Basically, operation check needs to be conducted in the same way as Chapter 4, OPERATION CHECK, in the PCR-L Series AC Power Supply Operation Manual. In doing so, also check the following.

- (1) The PCR-L Series AC Power Supply Operation Manual notes that nothing should be connected to the OUTPUT terminal board. However, for three-phase output operation, connect cables other than the output (load) cables as shown in the connection diagram in 3.2.2.
- (2) When turning ON the PCR-L AC Power Supply POWER switches, turn ON the POWER switch of the PCR-L AC Power Supply with the U-phase card (U-phase AC power supply) first or turn ON the POWER switches of three PCR-L AC Power Supplies simultaneously. Furthermore, the POWER switches of three AC power supplies must be turned ON/OFF in an interval of 3 second or less. Do not allow the condition where ON/OFF of one POWER switch differs from that of the other two POWER switches to continue for more than 3 sec.
- (3) When control panel display needs to be checked, check all the control panel displays of three AC power supplies.
- (4) For control panel display, see the Description given on the next page.
- (5) Use only the U-phase AC power supply to operate the control panel.
- (6) Add the following steps between steps 9 and 10 of the basic operation check.

**Step 9a** Press **[SHIFT]** + **[2]** (PHASE) to select line voltage display. This causes the voltage reading to be 51.5 to 52.5 V.

**Step 9b** Press **[SHIFT]** + **[2]** (PHASE) to select phase voltage display. This causes the voltage reading to be 29.7 to 30.3 V.

**Description****Difference in Display between Single- and Three-Phase Operations**

Use of three-phase operation with the 3-Phase Driver installed causes a part of control panel display to differ from that accomplished in single-phase operation.

(1) Indications common to each phase

- Indication of the  $\lambda$  mark and letter U, V, or W at the left of the voltage display area means that a PCR-L AC Power Supply has been set to the relevant phase and that the voltage reading shows phase voltage.
- Indication of letter U-V, V-W, or W-U at the left of the voltage display area means that the voltage reading shows the line voltage of the relevant power supplies.

(2) Display of the V- and W-phase AC power supply control panels

Each control panel displays phase (V or W) indication, voltage and current values, and LOAD level meter indication only.

(3) U-phase AC power supply control panel display

- During display of power, all of the  $\lambda$  mark and letters U, V, and W may appear at the left of the current display area. This indicates the total power of three phases.
- During self-test, the  $\lambda$  mark and letter U, V, or W may appear at the left of the voltage display area. This indicates the self-test result of the AC power supply of the displayed phase.

# Chapter 5

## OPERATION METHOD

Describes the operation and functions of the 3P02-PCR-L 3-Phase Driver.

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This operation manual describes how to use the functions which differ from those available when a PCR-L series AC Power Supply is used in single phase. For the contents not described in this manual, see the PCR-L Series AC Power Supply Operation Manual. Furthermore, before reading the 3-Phase Driver Operation Manual, always read the PCR-L AC Power Supply Operation Manual.

### Description

## Basic Operation Required for Three-Phase Operation

When the 3-Phase Driver is installed in PCR-L AC Power Supplies to perform three-phase operation, the following basic operation is required.

- (1) When turning ON the PCR-L AC Power Supply POWER switches, turn the POWER switch of the U-phase AC power supply first or turn the POWER switches of three AC power supplies simultaneously.
  - (2) Turn ON/OFF three PCR-L AC Power Supply POWER switches within three seconds. Be sure that all the three power supplies are always turned ON or OFF.
  - (3) Operate the POWER switches of the three power supplies in the same way. For example, do not turn only one POWER switch OFF and then ON again.
    - Incorrect use of a POWER switch may not start a PCR-L AC Power Supply. Should such a case happen, once turn OFF all the POWER switches and return them ON correctly.
  - (4) In three-phase operation, basically the U-phase AC power supply controls V- and W-phase AC power supplies; use the control panel of the U-phase AC power supply. Values set through the U-phase AC power supply control panel are set to all the power supplies in the same way.
  - (5) Only in phase voltage setting, the relevant voltage can be set using the V- or W-phase AC power supply control panel. This setting changes only the voltage of V- or W-phase AC power supply.
  - (6) Even if one power supply is not connected or if error occurs in one of three power supplies, all the PCR-L AC Power Supplies do not operate.
- Unless otherwise specified, the operation method described in this chapter applies to the U-phase AC power supply.

## 5.1 Switching between Phase Voltage and Line Voltage Displays

The 3-Phase Driver has the phase voltage and line voltage display modes. When the POWER is turned ON, the device selects the phase voltage display mode.

### Switching Procedure between Phase Voltage and Line Voltage Displays

Step 1

Press **[ESC]** to call the home position.

Step 2

Press **[SHIFT] + [2]** (PHASE). This changes phase voltage display to line voltage display or vice versa.

- Indication of the  $\Delta$  mark and letter U, V, or W at the left of the voltage display area means that the phase voltage display mode is selected.
- Indication of letters U-V, V-W, or W-U at the left of the voltage display area means that the line voltage display mode is selected.
- Switching from the phase voltage display mode to line voltage display mode requires that U-to-V phase difference be 120 degrees and U-to-W phase difference be 240 degrees. Furthermore, individually varying V- or W-phase voltage disables selection of the line voltage display. In this case, once vary a U-phase voltage value. This causes V- and W-phase voltages to be the same as U-phase voltage, allowing the line voltage display mode to be selected.
- Setting voltage in the line voltage display mode allows setting of line voltage.
- Line voltage display mode disables change of U-to-V or U-to-W phase difference.
- Line voltage display mode disables measurement of output power.
- Line voltage display mode disables individual setting of V- and W-phase voltages.
- Always make the connection shown in 3.2, "Connecting the SENSING Terminal Board."

## 5.2 Output Voltage Setting

- Setting a voltage value to the U-phase power supply causes the voltages of all phases to be the same.
- Setting a voltage value to the V- or W-phase power supply causes only V- or W-phase voltage to change. However, changing U-phase voltage after that causes both V- and W-phase voltages to be the same as U-phase voltage.
- Setting of V- or W-phase voltage requires that the phase voltage display mode be selected.
- Voltage setting in the phase voltage display mode sets phase voltage; set voltage 1/1.73 of the voltage required between lines. (This means that the U-to-V phase difference is 120 degrees and U-to-W phase difference is 240 degrees.)
- Voltage setting in the line voltage display mode sets line voltage; set the voltage required between lines, as is.
- For the voltage setting method and others, see the PCR-L AC Power Supply Operation Manual.

## 5.3 Limit Value Setting

- Limit value setting is available for voltage and frequency of the U-phase power supply.
- For setting of a current limit for each phase, the values applied before installing this device are effective. Therefore, if you wish to change a current limit value, remove the 3-Phase Driver to operate the PCR-L AC Power Supplies in single phase, then change the current limit values.
- For voltage and frequency limit values, the values determined on the U-phase power supply apply to all phases.
- A voltage limit value is a limit of phase voltage; a line voltage limit applies at the value 1.73 times greater than the phase voltage limit.

## 5.4 Setting the Current or Power Display Mode

- The current and power display modes change as follows whenever **[SHIFT]** + **[I]** (I MODE) are pressed.

Display of phase U

→ RMS → PEAK → W (U-phase power) → W (total power of three phase)

Display of phase V

→ RMS → PEAK → W (V-phase power) → W (V-phase power)

Display of phase W

→ RMS → PEAK → W (W-phase power) → W (W-phase power)

## 5.5 Memory Function

- Memory function is available only in the phase voltage display mode.
- The U-phase power supply allows the memory function of voltage and frequency.
- The V- and W-phase power supplies allow voltage memory function only.
- Voltage read from the U-phase power supply memory is set to all phases.

## 5.6 Key Lock Function

- Key lock function is individually available in all phases.

## 5.7 Self-Test Function

Use of the 3-Phase Driver allows the self-test of three PCR-L Series AC Power Supplies that operate in three-phase to be integrately conducted from the U-phase power supply.

- Self-test operating procedure is as described in the Alarm-Type Checking Procedure (SELF TEST) in Chapter 9, PROTECTIVE FUNCTIONS AND THEIR OPERATIONS, of the PCR-L AC Power Supply Operation Manual.
- Turning JOG causes “Ad.” and “No.” to change and also letter U, V, or W at the left of the voltage display area to change. Each letter indicates that the relevant phase AC power supply is under self-test.
- Some types of alarm causes an alarm number to be displayed on not only the relevant phase equipment but also AC power supplies in other phases.
  - a) Occurrence of alarm in one of three AC power supplies  
Alarm occurred in the relevant equipment.
  - b) Occurrence of alarm in two or more of three AC power supplies  
Alarm probably occurred in the equipment whose phase comes first in the order of phases W, V, and U.

- Example:
- If an alarm number appears on all of three AC power supplies, alarm possibly occurred in the W-phase equipment only.
  - If an alarm number appears on the U- and V-phase AC power supplies, alarm possibly occurred in the V-phase equipment only.

## 5.8 Functions Restricted during Three-Phase Operation

Use of the 3-Phase Driver allows the PCR-L Series AC Power Supplies to generate three-phase output. However, this restricts the PCR-L AC Power Supply functions partially. The following functions are disabled when the 3-Phase Driver is installed in PCR-L AC Power Supplies.

- DC mode
- AC + DC mode
- Sensing
- Regulation adjustment
- Average voltage value measurement
- Average current value measurement
- Current line abnormality simulation
- Current limit setting

# Chapter 6

## USING THE REMOTE CONTROLLER

Describes the functions and operation methods for three-phase operation accomplished using the 3-Phase Driver together with the Remote Controller (RC02-PCR-L).

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6.1 Switching between Phase Voltage and Line Voltage Displays .....	6-2
6.2 Setting U-to-V or U-to-W Phase Difference .....	6-3
6.3 Display of V- and W-Phase Currents, V- and W-Phase Voltages, and V-to-W and W-to-U Line Voltages .....	6-4
6.4 Selecting the Current or Power Display Mode .....	6-4
6.5 Sequence Operation .....	6-4
6.6 Harmonic Current Analysis .....	6-5
6.7 Special Waveform Output Function .....	6-5

Only the U-phase AC power supply allows installation of a Remote Controller. This manual describes how to use the functions different from those accomplished when a PCR-L Series AC Power Supply and Remote Controller are operated in single phase.

For the content not described in the 3P02-PCR-L Operation Manual, see the RC02-PCR-L Operation Manual. Furthermore, before reading this manual, always read the RC02-PCR-L Operation Manual.

## 6.1 Switching between Phase Voltage and Line Voltage Displays

The 3-Phase Driver offers the phase voltage and line voltage display modes. When the POWER is turned ON, the device selects the phase voltage display mode.

### Switching Procedure between Phase Voltage and Line Voltage Displays

**Step 1** Press **[ESC]** to call the home position.

**Step 2** Press **[SHIFT] + [2] (PHASE)**. This changes phase voltage display to line voltage display or vice versa.

- Indication of  $\lambda$  at the left of the voltage reading in the LCD screen means that the phase voltage display mode is selected.

50.00Hz	0.01A $\lambda$	0.2V
FRQ	I <sub>rms</sub>	V <sub>rms</sub>

- Indication of  $\Delta$  at the left of the voltage reading in the LCD screen means that the line voltage display mode is selected.

50.00Hz	0.01A $\Delta$	0.2V
FRQ	I <sub>rms</sub>	V <sub>rms</sub>

- Switching the phase voltage display mode to line voltage display mode requires that U-to-V phase difference be 120 degrees and U-to-W phase difference be 240 degrees. Furthermore, the voltage set value of each phase must be the same.
- Setting voltage in the line voltage display mode allows setting of line voltage.
- Line voltage display mode disables change of U-to-V or U-to-W phase difference.
- Line voltage display mode disables measurement of output power.
- Line voltage display mode disables individual change of V- and W-phase voltages.
- Always make the connection shown in 3.2, "Connecting the SENSING Terminal Board".

## 6.2 Setting U-to-V or U-to-W Phase Difference

**Step 1** Press **[ESC]** to call the home position.

**Step 2** Press **[MODE]**. This causes the following to appear.

FREE	0Ω
PHASE	IMP

**[F1]** **[F2]** **[F3]** **[F4]** **[F5]**

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

PHASE	FREE	FREE
	OUT_ON	OUT_OFF

**[F1]** **[F2]** **[F3]** **[F4]** **[F5]**

**Step 4** Press **[MENU]** to select the U-to-V phase difference/U-to-W phase difference setting mode. The following display appears.

PHASE	120deg	240deg
	U V	U_W

**[F1]** **[F2]** **[F3]** **[F4]** **[F5]**

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

**Step 6** Set phase difference.

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

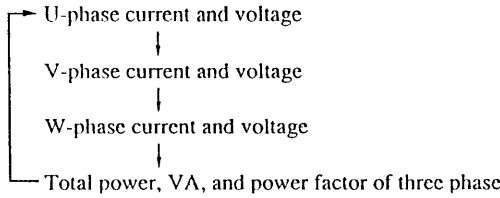


### 6.3 Display of V- and W-Phase Currents, V- and W-Phase Voltages, and V-to-W and W-to-U Line Voltages

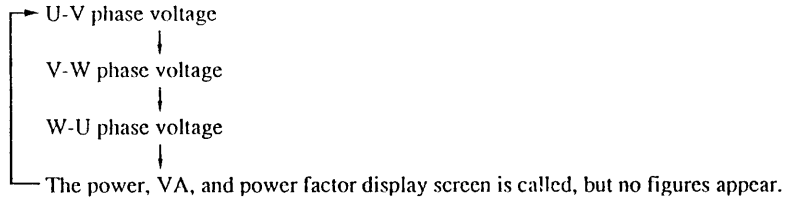
**Step 1** Press **[ESC]** to call the home position.

**Step 2** Press **[MENU]**. Each time this key is pressed, the display changes as follows:

For phase voltage display mode

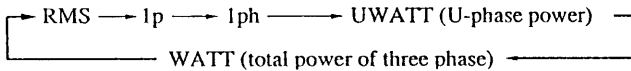


For line voltage display mode



### 6.4 Selecting the Current or Power Display Mode

- Whenever **[SHIFT]** + **[F3]** are pressed in the home position, the current and power display mode changes as follows:



### 6.5 Sequence Operation

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

## 6.6 Harmonic Current Analysis

The Remote Controller (RC02-PCR-L) connected to the U-phase AC power supply allows harmonic current analysis of load current in phases U, V, and W.

For this operation, add the following step between steps 2 and 3 in 4.4.3, Harmonic Current Analysis Function, of the RC02-PCR-L Operation Manual.

**Step 2a**

Select the phase to be harmonic current analyzed.

Current	Harmonic	
U	V	W

- Pressing **[F1]** selects phase U, **[F3]** phase V, and **[F5]** phase W.

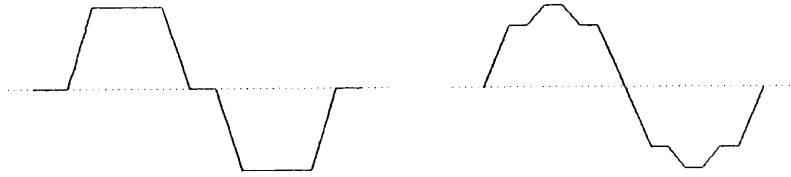
After that, follow from step 3 onwards in 4.4.3, Harmonic Current Analysis Function, of the RC02-PCR-L Operation Manual.

- Letter U, V, or W, which indicates the selected phase, appears at the left of the primary component of the harmonic current analysis result displayed on the screen.

## 6.7 Special Waveform Output Function

By using a Remote Controller (RC02-PCR-L) in conjunction, the Power Supply can deliver an output whose line voltage is of a peak clipped waveform. Note, however, that the phase voltage in this case will become as illustrated below.

The valid setting range is 1.25 to 1.40. If you specify a value outside of the valid setting range, the Power Supply will not deliver its output. (Within the range of 1.10 to 1.24, you can enter numerical values only. In this case the output will be sinusoidal.)



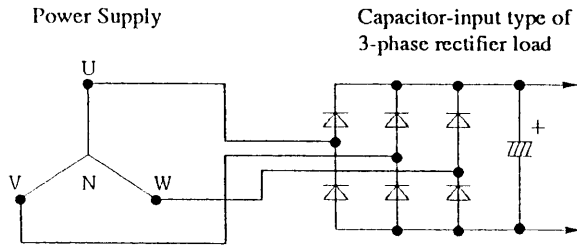
Line voltage waveform

U-V  
V-W  
W-U

Phase voltage waveform

U-N  
V-N  
W-N  
(N: Neutral)

[Comments] A typical capacitor-input-type of 3-phase rectifier circuit is as shown below. With this circuitry, the phases of the currents are 60 or 120 degrees with respect to those of the voltages. Due to this, the voltage waveforms become as illustrated in the above.



# Chapter 7

## USING THE GP-IB/RS-232C INTERFACE

Describes the functions and commands available when the 3-Phase Driver and GP-IB Interface (IB11-PCR-L) or RS-232C Interface (RS11-PCR-L) are used in combination for three-phase operation.

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7.2 Line Voltage and Phase Voltage Displays ([VLIN] and [VPHASE] Commands) .....	7-3
7.3 Output Voltage Setting ([VESET], [ACVSET], and [LINEVSET] Commands).....	7-3
7.4 Voltage and Current Measurements ([VOUT?] and [IOUT?] Commands) .....	7-4
7.5 Power, Power Factor, and Volt-Ampere Measurement ([WATT?], [PF?], and [VA?] Commands) .....	7-5
7.6 Harmonic Current Analysis ([UCURHARMA?] Command and Others) .....	7-5

Either the GP-IB Interface or RS-232C Interface can be installed in the U-phase AC power supply. This Manual describes the functions different from those available when a PCR-L Series AC Power Supply and GP-IB Interface or RS-232C Interface are operated in single phase. For the contents not described in this manual, see the IB11/RS11-PCR-L Operation Manual. Furthermore, before reading the 3P02-PCR-L Operation Manual, always read the IB11/RS11-PCR-L Operation Manual.

## 7.1 Setting U-to-V and U-to-W Phase Differences ([PHASEV] and [PHASEW] Commands)

The [PHASEV] command is used to set U-to-V phase difference and the [PHASEW] command to set U-to-W phase difference. The [PHASEV?] and [PHASEW?] commands are available to read the U-to-V and U-to-W phase differences respectively.

The [PHASEV] and [PHASEW] command program data are integers of 0 to 360 and their initial set values at factory shipment are as follows:

Header	Initial value
[PHASEV]	120
[PHASEW]	240

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

Examples: PHASEV 125 Sets U-to-V phase difference to 125 degrees.  
 PHASEW 238 Sets U-to-W phase difference to 238 degrees.

## 7.2 Line Voltage and Phase Voltage Displays ([VLIN] and [VPHASE] Commands)

The measured voltage value display method is selectable between line voltage display ([VLIN] command) and phase voltage display ([VPHASE] command). These commands have no program data. When the POWER switch is turned ON, phase voltage display is selected.

- Setting of any data other than the initial value to U-to-V or U-to-W phase difference disables selection of the line voltage display mode; the [VLIN] command is not available in this case.
- Line voltage setting is available only in the line voltage display mode.
- Phase voltage setting is available only in the phase voltage display mode.
- Power, volt-ampere, and power factor measurements are available only in the phase voltage display mode.
- Always make the connection shown in 3.2, "Connecting the SENSING Terminal Board".

## 7.3 Output Voltage Setting ([VSET], [ACVSET], and [LINEVSET] Commands)

Output voltage setting includes phase voltage setting ([VSET] and [ACVSET] commands) and line voltage setting ([LINEVSET] command).

- The [VSET] and [ACVSET] commands function the same.
- Output voltage setting sets the voltages of all phases to the same value.
- The [VSET] and [ACVSET] commands are enabled only in the phase voltage display mode.
- The [LINEVSET] command is enabled only in the line voltage display mode.
- [VSET] and [ACVSET] command program data have the same range as those available in single phase operation. The [LINEVSET] command allows its program data to be settable to voltage 1.73 time greater than [VSET] command program data.

## 7.4 Voltage and Current Measurements ([VOUT?] and [IOUT?] Commands)

In the same way as single-phase operation, the [VOUT?] and [IOUT?] commands are available to read the measured voltage and current values.

- [VOUT?] command query data show U-, V-, and W-phase voltages which are separated using a comma (,) in the phase voltage display mode, and U-to-V, V-to-W, and W-to-V voltages separated using a comma (,) in the line voltage display mode.

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

```
VOUT 115.3V, 115.4V, 115.5V
```

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

```
VOUT 200.0V, 200.1V, 200.2V
```

- [IOUT?] command query data show U-, V-, and W-phase currents which are separated using a comma (,).

Example: [IOUT?] command query message

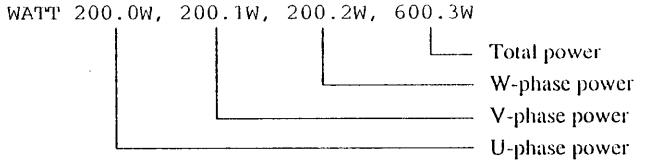
```
IOUT 10.0A, 10.1A, 10.2A
```

### 7.5 Power, Power Factor, and Volt-Ampere Measurement ([WATT?], [PF?], and [VA?] Commands)

In the same way as single-phase operation, the [WATT?], [PF?], and [VA?] commands are available to read the measured power, power factor, and volt-ampere values.

- These commands are disabled in the line voltage display mode.
- The query data of each command are data of U-phase, V-phase, W-phase, and the total of three phases which are separated using a comma (,).

Example: [WATT?] command query message



### 7.6 Harmonic Current Analysis ([UCURHARMA?] Command and Others)

Harmonic current analysis is available in the same way as single-phase operation. However, since this feature reads analysis data on a phase basis, the command is provided for each phase. See the table below and the IB11-PCR-L or RS11-PCR-L Operation Manual.

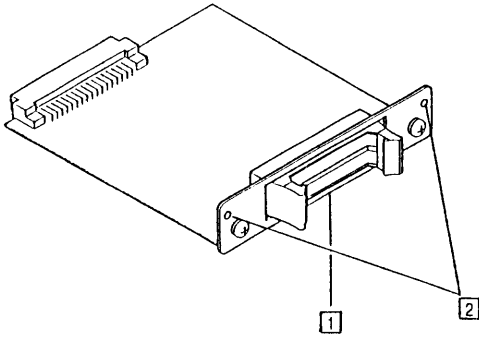
	Equivalent to the [CURHARMA] command in single phase	Equivalent to the [CURHARMP] command in single phase
Phase U	[UCURHARMA]	[UCURHARMP]
Phase V	[VCURHARMA]	[VCURHARMP]
Phase W	[WCURHARMA]	[WCURHARMP]



## **Chapter 8**

# **PART NAMES**

Indicates the names of the parts of the 3P02-PCR-L and describes the functions of these parts.



- 1 Drive signal connector  
Used to connect a drive signal cable.
- 2 Mounting holes  
Used to mount the phase card.

# Chapter 9

## MAINTENANCE

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## 9.1 Before Requesting a Repair

If a problem occurs in the 3P02-PCR-L, check that problem in accordance with the following table. Also, disconnect the 3-Phase Driver from the PCR-L AC Power Supplies and check if the power supply alone operates normally. If it is not possible to recover a normal status, contact your Kikusui agent to request repairs.

Problem	Check item	Results	Possible causes
PCR-L AC Power Supply display panel displays "Err2", nothing, or keeps the version number indication.	Check if the three phase cards are correctly inserted into a slot.	No	Improper phase card installation (see 3.1.1)
	Check if the drive signal cables are correctly connected.	No	Improper drive cable connection (see 3.1.2)
	Check if the three PCR-L AC Power Supply POWER switches are ON.	No	No three-phase operation is available unless the three PCR-L AC Power Supply POWER switches are turned ON.
Rated output cannot be generated.	Check if the output neutral point is connected to a load, or if a load is connected in three-phase four-wire system (star connection).	No	Cables are arranged in delta connection. Delta connected load may cause current unbalance between three phases, which disables generation of rated output.
Voltage different from the set voltage is generated (square root 3 times or 1/square root 3).	Check if display mode is normal.	No	The phase voltage display mode sets phase voltage; the line voltage display mode sets line voltage.
Voltage display becomes abnormal in the line voltage display mode.	Check if SENSING terminal board connection is correct.	No	Incorrect cable connection to the SENSING terminal board. This disables line voltage measurement (see 3.2.2).

# Chapter 10

## SPECIFICATIONS

List the specifications.

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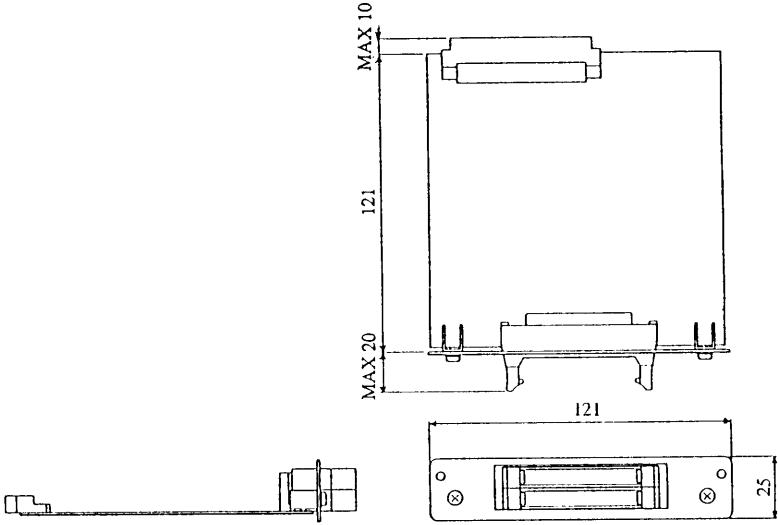
## 10-1 Specifications

The specifications given in this section cover the comprehensive performance where the 3-Phase Driver is installed in the PCR-L AC Power Supplies to configure three-phase power supply. Other specifications comply with those of the PCR-L Series AC Power Supply.

Input/output power capacity (total power of three phases)	[Power capacity of one PCR-L AC Power Supply] × 3
Input current capacity	[Current capacity of one PCR-L AC Power Supply] × square root 3 (for three-phase delta connection) [Current capacity of one PCR-L AC Power Supply] × 3 (for single-phase connection)
Output current capacity (phase current for each phase)	[Current capacity of one PCR-L AC Power Supply] × 1
Output phase voltage phase difference *1	Within 120 deg ±(0.4 deg + 5 μS) Within (120 deg ±(0.4 deg + $f_0 \times 1.8 \times 10^{-3}$ deg) $f_0$ stands for output frequency. *2

- \*1 Phase difference between output voltages (phase voltages) when each phase is checked from the neutral point with no phase difference varied (120 deg between phases)
- \*2 Examples of the noted expression which is angular converted at a specific frequency  
Within 120 deg ±0.5 deg (for the case of 60 Hz output)  
Within 120 deg ±1.2 deg (for the case of 400 Hz output)

### 10.2 Dimensions



Unit: mm

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