

Constant Current Output / Regenerative Electronic Load Option Manual

Ver. 6.xx models

PCR6000WEA2R

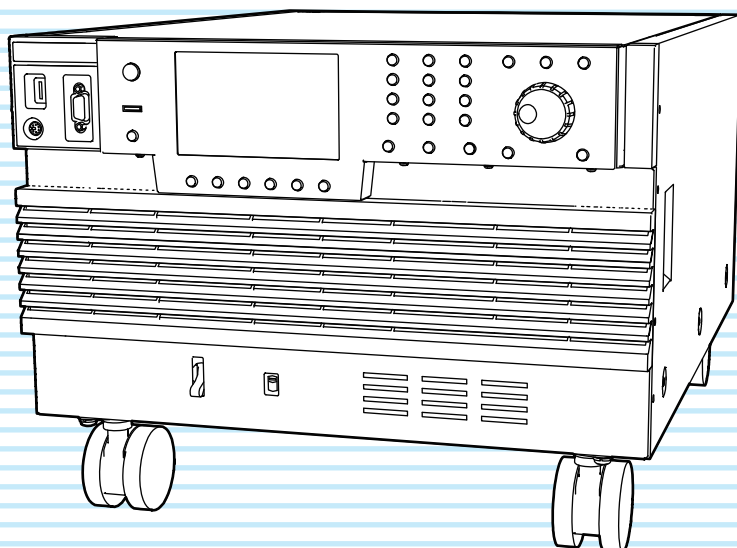
PCR12000WEA2R

PCR18000WEA2R

PCR24000WEA2R

PCR30000WEA2R

PCR36000WEA2R



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Introduction

About Manuals

This manual provides an overview of this product and notes on usage. It also explains how to configure it, operate it, perform maintenance on it, and so on. Read this manual thoroughly before use, and use the product properly.

Intended readers

These manuals are intended for users of this product and their instructors. The manuals assume that the reader has knowledge about power supplies.

Manual construction

User's Manual

This document is intended for first-time users of this product. It provides an overview of the product, notes on usage, and specifications. It also explains how to connect the product, configure the product, operate the product, perform maintenance on the product, and so on.

Communication Interface Manual

This document contains details about remote control. The interface manual is written for readers with sufficient basic knowledge of how to control measuring instruments using a PC.

Setup Guide

This document is intended for first-time users of the product. It gives an overview of the product, safety precautions, and so on. Please read this guide before you operating this product.

Quick Reference

This document briefly explains the control panel and the basic operation of it.

Constant Current Output / Regenerative Electronic

Load Option Manual (this document)

This document contains the functions, operation, safety precautions, and specifications specific to the constant current output/regenerative electronic load mode, which is a factory default option.

Safety Information

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

PDF files are included in the accompanying CD-ROM.

You can download the most recent version of these manuals from the Kikusui Electronics Corporation website.

Firmware versions that this manual covers

This manual is applicable to the products with the constant current output/regenerative electronic load function option (firmware version 6.xx).

When contacting us about the product, please provide us with:

- Model
- Firmware version
- Serial number

For information on how to check the model firmware version, and serial number, see Viewing the firmware version ([p.210](#)).

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Disposal

Dispose of the product in accordance with your local regulations.

Open Source Software

This product contains open source software under the licensing terms of GNU General Public License (GPL), GNU LESSER General Public License (LGPL), and other licenses. For details, see the following URL.

<https://rddocuments.kikusui.co.jp/oss/pcrwe>

Applicable Models

This manual is applicable to the following products with the constant current output/regenerative electronic load mode, which is a factory default option.

Models

Firmware version	Applicable model	Input voltage
Versions 6.xx	PCR6000WEA2R	Three-phase 200 V input
	PCR12000WEA2R	
	PCR18000WEA2R	
	PCR24000WEA2R	
	PCR30000WEA2R	
	PCR36000WEA2R	

When using products not equipped with the constant current output/ regenerative electronic load mode, see the User's Manual.

How to Read This Guide

This manual contains the descriptions specific to the constant current output/ regenerative electronic load mode. The descriptions in this manual are specific to a mode or common to the modes.

- CV Supply: Mode used as a CV (constant voltage) power supply
- CC Load: Mode used as a CC (constant current) electronic load
- CV Supply: Mode used as a CC (constant current) power supply

Correspondence table of manual chapters for each mode

Chapter	CV Supply	CC Load	CC Supply
Introduction (p.6)	✓	✓	✓
Component Names (p.9)	✓	✓	✓
Selecting Operation Mode (p.16)	✓	✓	✓
CC LOAD Mode (p.18)	--	✓	--
CC SUPPLY Mode (p.80)	--	--	✓
Sequence Function (p.132)	-- ¹	✓	✓
External Control (p.168)	-- ¹	✓	✓
Parallel Operation (p.202)	✓	✓	✓
System Settings (p.203)	-- ¹	✓	✓
Maintenance (p.211)	✓	✓	✓
Specifications (p.212)	-- ¹	✓	✓
Appendix (p.229)	✓	✓	✓

1. It is the same function as a conventional CVpower supply. See the User's Manual for version 4.xx models.

Notations Used in This Manual

- In this manual, the PCR6000WEA2R, PCR12000WEA2R, PCR18000WEA2R, PCR24000WEA2R, PCR30000WEA2R, and PCR36000WEA2R may be referred to as the "PCR-WEA2R" or "PCR-WEA."
- "PC" in this document is a generic term for personal computers and workstations.
- The screen captures and illustrations used in this manual may differ from the actual items.
- The following markings are used in this manual.

⚠ WARNING

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

⚠ CAUTION

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

NOTE

Indicates information that you should know.



Indicates a reference manual (CD-ROM) containing detailed information.

>

This symbol indicates the hierarchy of the items you select with the panel and function keys. The item to the left of this symbol ">" indicates a higher-level item.

For example, "Press V > ACVOLT (F1)" indicates that you need to press the V key and then the ACVOLT (F1) function key.

(SHIFT + key name)

Indicates an operation that requires you to press a key indicated in blue characters (the lower row of text to the left of the key) while holding down SHIFT.

Notes

Use the product correctly after reading the details of “Safety Precautions,” “Precautions When Choosing the Installation Location,” and “Moving the Product” in the User’s Manual.

The following notes are only applicable to the models with the constant current output/regenerative electronic load option. However, those are not applicable to the CV Supply mode.

WARNING

Risk of electric shock.

Do not touch the output terminal immediately after OVP (overvoltage protection) is activated.

Residual voltage may exist on the output terminal. It takes about 5 seconds until residual voltage is discharged.

CAUTION

Risk of damage to EUT.

- This product achieves the CC (constant current) modes by controlling the internal voltage source. Even if the output terminal is opened or the EUT stops, the internal voltage source may output the maximum voltage to maintain the specified current. For safety use, the following countermeasures are recommended:
 - Set OVP, peak OVP, and peak OVP trip time correctly
 The product can be stopped in faulty situations by setting OVP to a slightly higher voltage than used (approx. 110% to 120%).
 A time lag (up to 100 ms) may occur from OVP detection to stop.
 A time lag between peak OVP and peak OVP trip time can be minimized by setting them together.
 - Use CR (constant resistance) mode
 In CR mode, this product passes a current proportional to the applied voltage, so no current flows when no voltage is applied.
 If the resistance setting is high, a high voltage may be output due to an offset current measurement (approx. a few milliamperes).
- If DC is used in the CC Load mode, the product may generate negative voltage for the EUT while the load of the product is turned on with the EUT deactivated. Turn the load off on this product, then turn off the output of the EUT.
- If the EUT serves as a voltage source, an inrush current flows when OUTPUT is turned on (load on).
 For AC, an inrush current can be reduced by setting ON Phase (p.40), (p.89) to 0 deg. To reduce an inrush current with OUTPUT turned on for any phase, use the sequence function to set OUTPUT to ON with Current Setting: 0 A and ON Phase: 0 deg. It is recommended that settings are entered after a step.
 For DC, an inrush current can be reduced by connecting a reactor between the EUT and the product in series though the product has no settings against such a current.

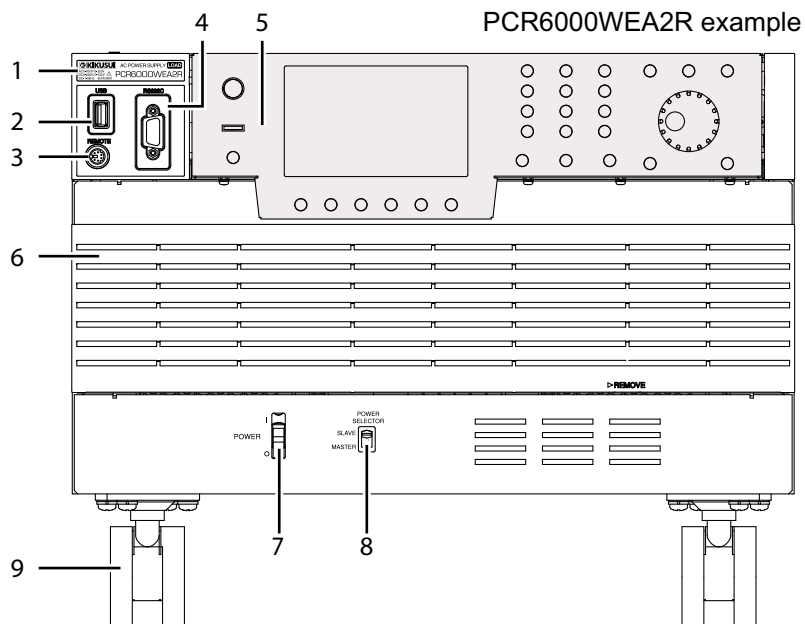
Risk of damage to this product.

Do not apply voltage to the output terminal in the following cases:

- The product’s POWER switch is turned off (O).
- When switching operation modes.
- “Busy” is shown on the display (for example, when a wiring method is changed and when an output range is switched).

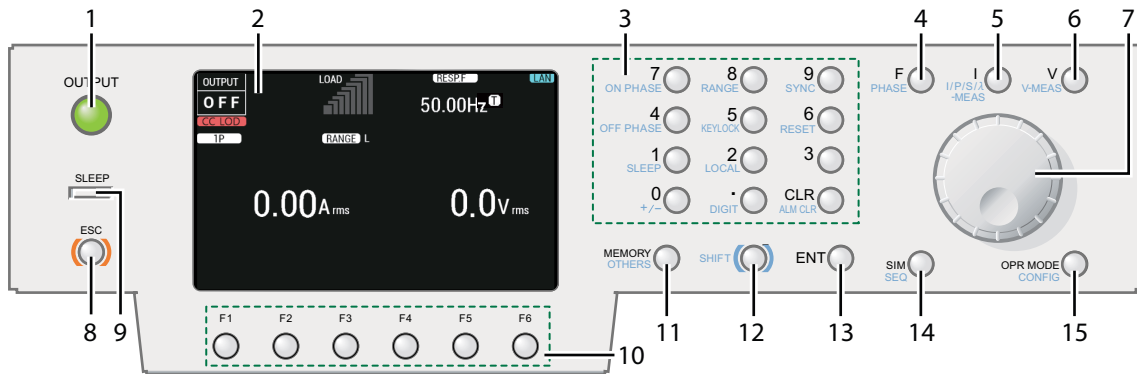
Component Names

Front panel



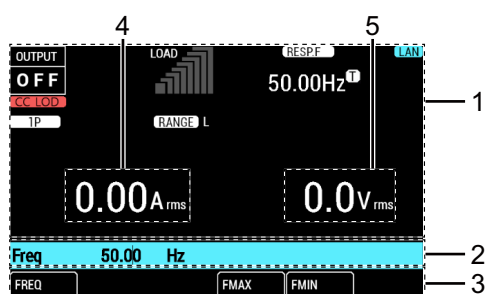
No.	Name	Function
1	Product label	Indicates the model name. Indicates "LOAD" in the border for the models with the constant current output/regenerative electronic load function option.
2	USB port (host)	For connecting an external keyboard Saves to setup memory. Used for updating.
3	REMOTE connector	Connector for the optional line impedance network or dip simulator.
4	RS232C port	RS232C port for remote control.
5	Control panel	Operation panel and display.
6	Power module air inlet	Inlet holes for cooling.
7	POWER switch	Flip the switch to the (I) side to turn the power on and to the (O) side to turn it off.
8	POWER SELECTOR switch	Power on/off sync switch for parallel operation.
9	Casters	4 locations

Control panel



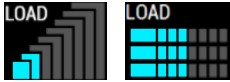
No.	Name	Function
1	OUTPUT	Turns the output on and off. (Turns the load on and off for the CC Load mode.)
2	Display	Displays the settings, measured values, and other information.
3	Numeric keys	Enters values directly.
	CLR key	Clears the input entered with the numeric keypad.
	ON PHASE key	Sets the output-on phase.
	RANGE key	Switches the voltage/current range.
	SYNC key	Sets the sync function.
	OFF PHASE key	Sets the output-off phase.
	KEYLOCK key	Locks or unlocks the keys.
	RESET key	Resets the product.
	SLEEP key	Sets the sleep function.
	LOCAL key	Switches to local mode from remote mode.
	+/- key	Switches the voltage polarity of the DC output.
	DIGIT key	Moves to the left digit when setting a value.
	ALM CLR key	Clears the alarm.
4	F key	Sets the frequency.
	PHASE key	Switches the displayed phase during multi-phase operation.
5	I key	Sets the current parameters.
	I/P/S/A-MEAS key	Switches between current, power, and power factor displays.
6	V key	Sets the voltage parameters.
	V-MEAS key	Switches the voltage display.
7	Rotary knob	Rotary knob
8	ESC key	Returns to the previous level or cancels operations.
9	SLEEP LED	Blinks in sleep mode.
10	Function keys	Executes the function shown above the keys.
11	MEMORY key	Saves and recalls from memory.
	OTHERS key	Sets advanced operations.
12	SHIFT key	Enables the functions that are written in blue characters in the bottom row to the left of each key.
13	ENT key	Confirms the settings.
14	SIM key	Not used.
	SEQ key	Sets the sequence operation.
15	OPR MODE key	Sets the operation.
	CONFIG key	Sets CONFIG parameters.

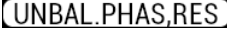
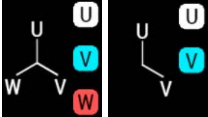
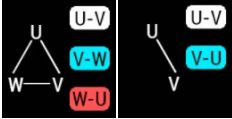
Display and Icons



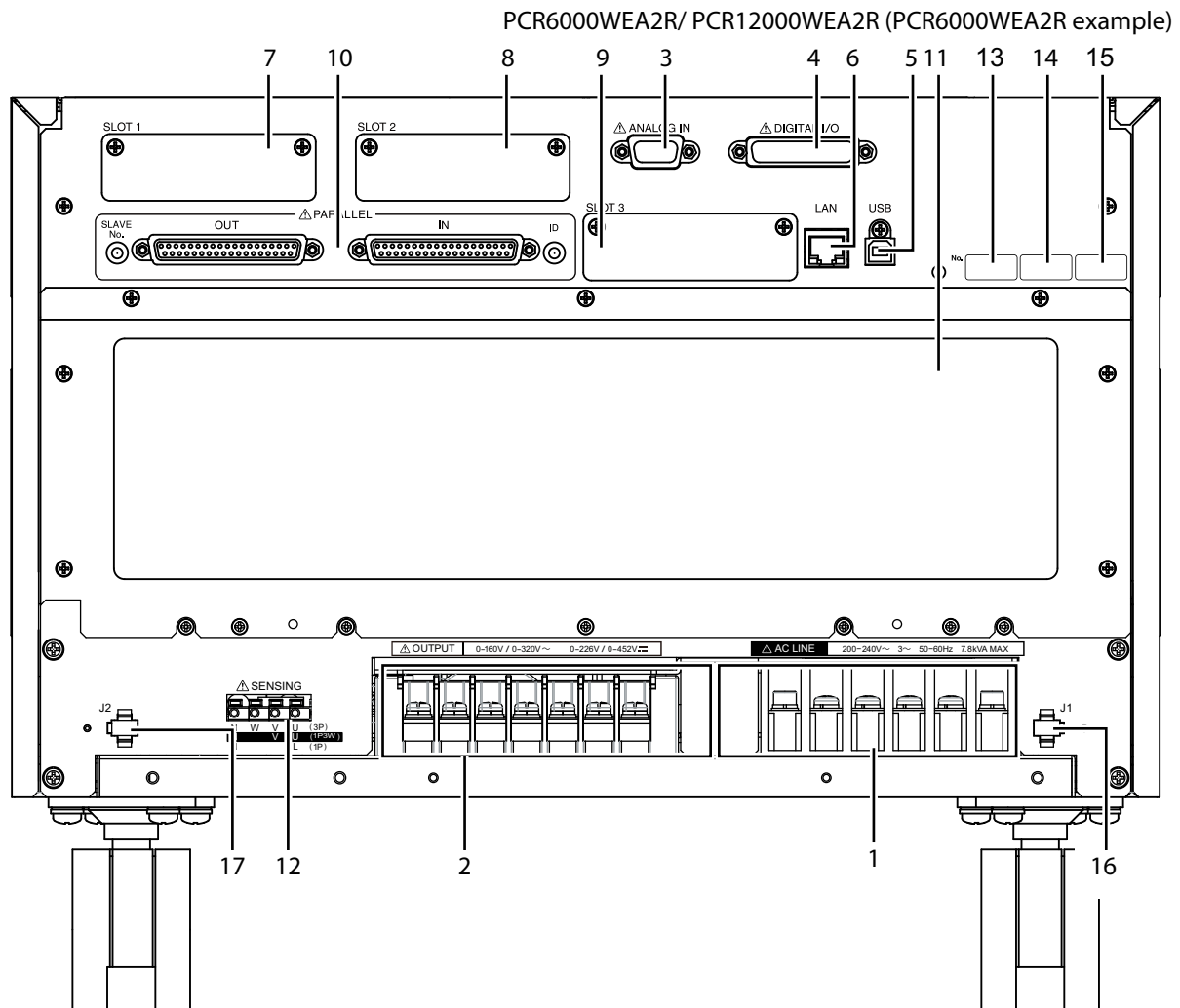
No.	Name		Function
1	Status, measured-value, and setting display area		Displays the product's present status, measured values, and settings.
2	Entry area		Area for entering system settings.
3	Function key name area		Displays the present functions above the function keys (F1 to F6).
4	Current, power, or power factor display	A rms	Displays the rms current
		A pk	Displays the peak current
		A dc	Displays the average current
		W/ kW	Displays the power
		VA	Displays the apparent power
		λ	Displays the power factor
5	Voltage display	V rms	Displays the rms voltage
		V pk	Displays the peak voltage
		V dc	Displays the average voltage

Icon	Description
	CV Supply mode
	CC Load mode
	CC Supply mode
	Single-phase output
	Single-phase three-wire output
	Three-phase output
	AC coupling on
	CR function on
	Reactive current suppression function operating
	Reactive current suppression function stopped
	Alarm generation
	Synchronizing with an external clock signal.
	Key operation is not possible while internal processing is in progress.
	Waiting for confirmation (blinking)
	There is a SCPI error.
	Amplifies the input waveform using an external signal.

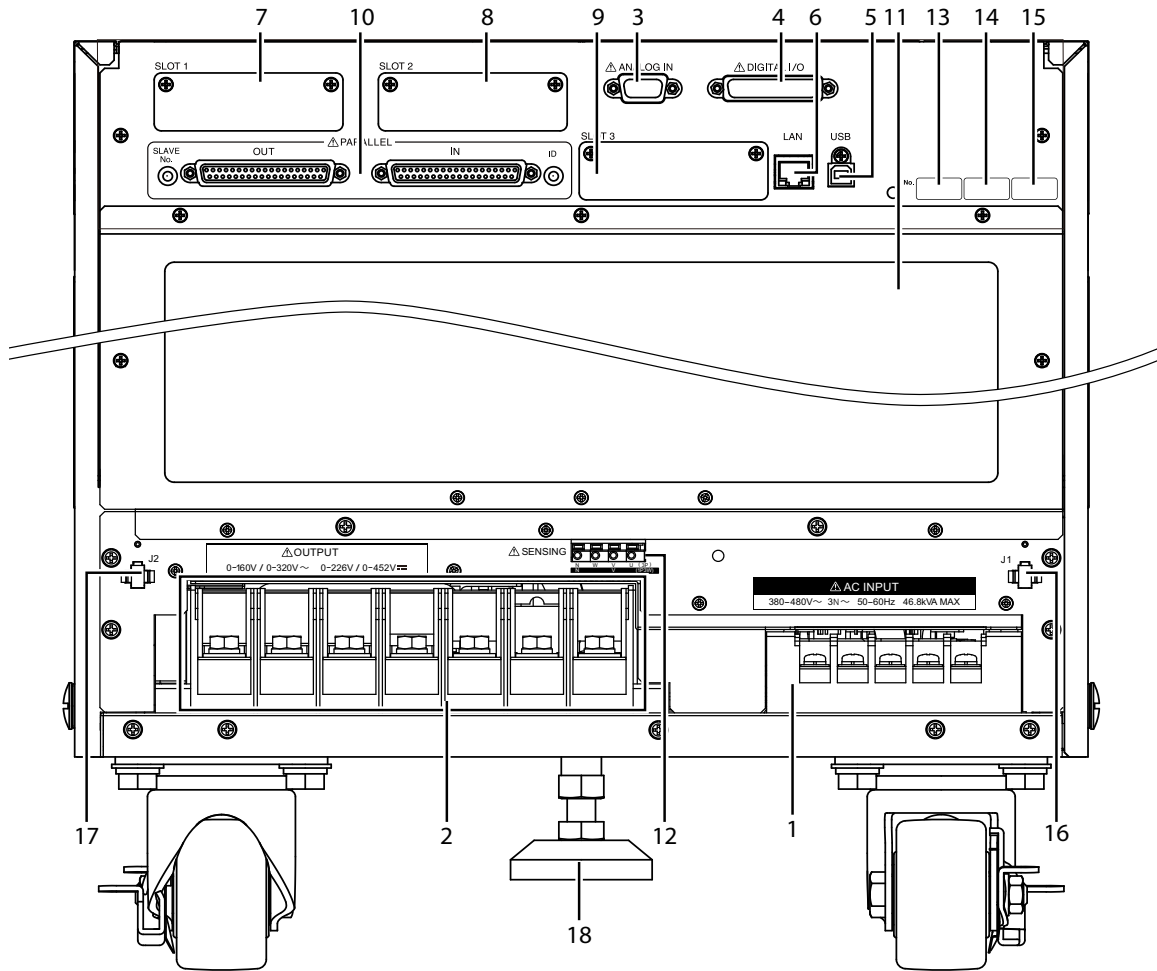
Icon	Description
EXT SYNC	Lights when the external sync function is in use. Blinks until synchronization is established.
EXT SYNCNG	Unable to sync to the external sync input signal.
EXT SYNC +P	Lights when the external sync function is in use (with the delay phase angle set). Blinks until synchronization is established.
FALL TIM	Enables soft stop
INT+EXT	Amplifies the input waveform using the internal signal and external signal.
VPROG	Changes the current or a frequency with an external signal.
IPK.LIM	Peak current limit activated (only for the CV Supply mode)
KEYLOCK	Keys locked
LAN	LAN status, red: not connected, orange: connecting, green: communication possible, blinking: identify status
	Load level meter
OFF PHASE	Output-off phase setting
ON PHASE	Output-on phase setting
OUTPUT ON	Output on
OUTPUT OFF	Output off "OFF" blinks when soft stop is in use.
OUTPUT+ OFF	Output off Voltage surge suppression function off
OVERLOAD	Overload occurrence
POW 18kVA	Power save mode
[RANGE] H	Voltage/current range H
[RANGE] L	Voltage/current range L
RESET	Waiting for reset confirmation or reset in progress
RESP.F	Response: High speed (FAST)
RESP.MF	Response: Medium speed (MED FAST) (only for the CC Load and CC Supply modes)
RESP.MS	Response: Stable speed (MED SLOW) (only for the CC Load and CC Supply modes)
RESP.M	Response: Normal speed (MEDIUM) (only for the CV Supply mode)
RESP.S	Response: High stability response (SLOW)
RISE TIM	Enables soft start
RMT	Remote mode
SENS.-H	Compensation: hard sensing
SYNC	Lights when the LINE sync function is in use. Blinks until synchronization is established.
SYNC+P	Lights when the LINE sync function is in use (with the delay phase angle set). Blinks until synchronization is established.
SYNC NG	Lights when synchronization cannot be established with the input power supply.

Icon	Description
	Lights when the TERM sync function is in use. Blinks until synchronization is established.
	Lights when the TERM sync function is in use (with a positive delay phase angle set). Blinks until synchronization is established.
	Lights when the TERM sync function is in use (with a negative delay phase angle set). Blinks until synchronization is established.
	TERM synchronization has not been established.
	Non-zero waveform bank number
	Sequence ended with the U phase offset.
	Unbalanced phase difference
	Unbalanced current
	Unbalanced resistance
	Unbalanced phase difference and current
	Unbalanced phase difference and resistance
	Unbalanced current and resistance
	Unbalanced phase difference, current and resistance
	Unbalanced voltage
	Unbalanced phase difference and voltage
	Output frequency setting
	Measured frequency value (LINE input)
	Measured frequency value (EXT input)
	Measured frequency value (TERM input)
	All phase (phase voltage) display for three-phase output or single-phase three-wire output
	All phase (line voltage) display for three-phase output or single-phase three-wire output

Rear panel



PCR18000WEA2R/ PCR24000WEA2R/ PCR30000WEA2R/ PCR36000WEA2R (PCR36000WEA2R example)



No.	Name	Function
1	AC INPUT	Terminal block connectors for power cords, with cover
2	OUTPUT terminal block	Output terminal block with a cover (used as an input terminal block in the CC Load mode)
3	ANALOG IN connector	Analog control connector
4	DIGITAL I/O connector	Digital control connector
5	USB port (device)	USB port for remote control.
6	LAN port	LAN port for remote control.
7	SLOT1	Not used.
8	SLOT2	Slot for analog monitor output (factory option)
9	SLOT3	Slot for a GPIB interface board (option)
10	PARALLEL connector	Connector for parallel operation
11	Power module air outlet	Air outlet for cooling
12	SENSING terminal block	Connects the sensing cables.
13	Serial number	PCR-WEA2R serial number
14	Model by input voltage	Input voltage model (200 V) is indicated in the box.
15	Optional model	Indicates "500 Hz Limit Model" or "Constant Current Output/ Regenerative Electronic load Function Option," if applicable, in the border.
16	J1 connector	Power sync connector for parallel operation
17	J2 connector	
18	Stopper	Stopper for fixing the product to the floor

Selecting Operation Mode

The models with the constant current output/regenerative electronic load function option (firmware version 6.xx) are used by selecting an operation mode.

⚠ CAUTION

Risk of malfunction.

- Check that the intended use of the PCR-WEA matches the actual operation mode.
- The factory default settings and protection function settings depend on the operation modes. Also, since the settings are stored individually, the settings from other operation modes are not carried over. If the operation mode is switched, check the settings before turning OUTPUT on (Load on).

■ CV Supply mode

It is the same function as the conventional PCR-WEA. The product operates as an AC power supply with the CV (constant voltage) mode.

After selecting the CV Supply mode, see the User's Manual.

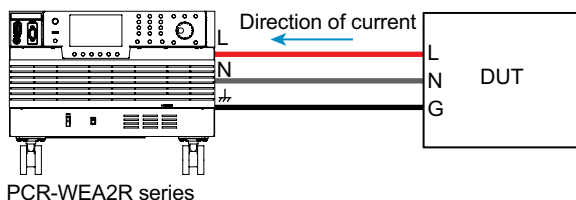
■ CC Load mode

The product operates as an electronic load with the CC (constant current) mode.

It can be used as an AC electronic load by changing the direction of current.

This manual describes how to use the product as an electronic load.

CC LOD CC (constant current) electronic load mode

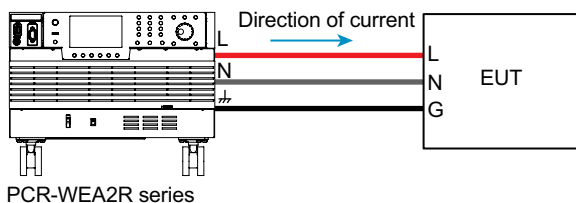


■ CC Supply mode

The product operates as an AC power supply with the CC (constant current) mode.

This manual describes the settings and specifications for the CC Supply mode.

CC SUP CC (constant current) power supply mode

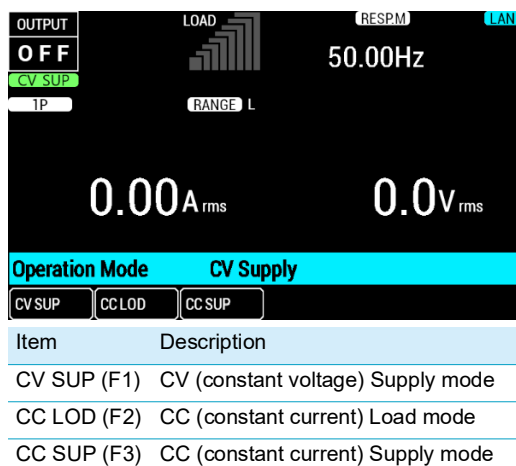


Procedure for Switching the Operation Mode

1 Press CONFIG (SHIFT+OPR MODE) > 1/3 (F6) > 2/3 (F6) > OPE MODE (F4).

2 Select the operation mode to be used.

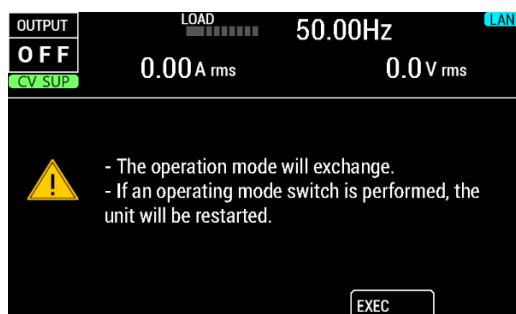
The factory default setting is CV Supply mode .



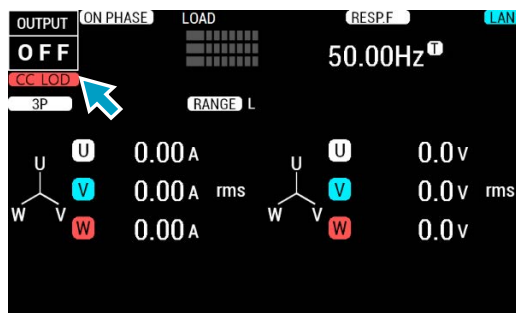
3 A confirmation screen for switching the operation mode appears.

Press EXEC to apply an operation mode changeover. As a verification screen is displayed, press OK.

PCR-WEA will restart.



4 Check that the icon is shown on the display.



This completes the setting.

CC LOAD Mode

This chapter explains how to use the CC Load mode.

Installation and Preparation

Connecting the Power Cord

See "Connecting the Power Cord" in the User's Manual.

Turning the Power On

See "Turning the Power On" in the User's Manual.

Connecting to the DUT

The PCR-WEA has an OUTPUT terminal on the rear panel. In CC Load mode, the OUTPUT terminal is used as the load input terminal.

WARNING

Risk of electric shock.

- Do not use the terminal block with the terminal cover removed.
- Use cables with a rated voltage higher than the isolation voltage of the PCR-WEA series for load cables.
- When connecting to the OUTPUT terminal block (load input terminal), be sure to turn off the POWER switch to cut off the power supply from the switchboard.

Using improper cables may cause fire.

- Use load cables having strong flame-resistant insulation with sufficient margin for the current.
-

CAUTION

Risk of heat buildup or spark emission. Fasten the wires securely at the recommended torque.

Selecting the load cable

■ Current capacity of load cables

If you use load cables whose capacity meets or exceeds the rated output current, even if the load is shorted, the cables will not be damaged. The load cables that you use must have a current capacity that allows the product's rated output current to flow. Using the following table as a reference, select wiring whose nominal cross-sectional area is as thick as possible. A cable's temperature is determined by the resistive loss based on the current, the ambient temperature, and the cable's external thermal resistance. The following table shows the current capacity of heat-resistant vinyl cables that have a maximum allowable temperature of 60 °C when one of the cables is separated and stretched out horizontally in air in an ambient temperature of 30 °C. The current must be reduced under certain conditions, such as when vinyl cables that have a low heat resistance are used, when the ambient temperature is 30 °C or greater, or when cables are bundled together and little heat is radiated.

Nominal cross-sectional area [mm ²]	AWG	(Reference cross-sectional area) [mm ²]	Allowable current ¹ [A] (at Ta = 30 °C / 86 °F)	Kikusui-recommended current [A]
0.9	18	(0.82)	17	--
1.25	16	(1.31)	19	--
2	14	(2.08)	27	10
3.5	12	(3.31)	37	--
5.5	10	(5.26)	49	20
8	8	(8.37)	61	30
14	6	(13.3)	88	50
22	4	(21.15)	115	80
30	2	(33.62)	139	--
38	1	(42.41)	162	100
50	1/0	(53.49)	190	--
60	2/0	(67.42)	217	--
80	3/0	(85.03)	257	200
100	4/0	(107.2)	298	--
125	--	--	344	--
150	--	--	395	300
200	--	--	469	400

1. * Excerpt from Japanese laws related to electrical equipment.

■ Taking measures against noise

When connecting cables that have the same heat resistance, separating the cables as much as possible to increase heat radiation enables a greater amount of current to flow. However, wiring the + (positive) and - (negative) output wires of the load cable side by side or bundling them together is more effective against unwanted noise. The Kikusui-recommended currents shown in the above table are allowable currents that have been reduced in consideration of the potential bundling of load cables. Use these values as a guideline when connecting cables.

Connecting the PCR6000WEA2R/PCR12000WEA2R

In CC Load mode, the OUTPUT terminal of the PCR-WEA is used as the load input terminal.

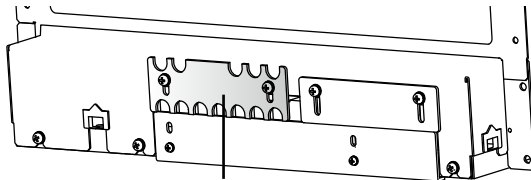
WARNING

Risk of electric shock.

- Attach the OUTPUT terminal cover so that the terminals are not exposed according to the input system.
- To use single-phase input, be sure to connect three cables each for L and N. You may accidentally touch unused terminals through gaps in the OUTPUT (load input) terminal cover.

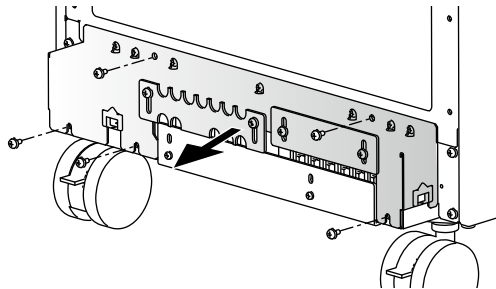
When the product is shipped from the factory, an OUTPUT terminal cover is attached to keep the OUTPUT terminals from becoming exposed.

If you are not using the OUTPUT terminal block, attach the terminal cover so that the terminals are not exposed.

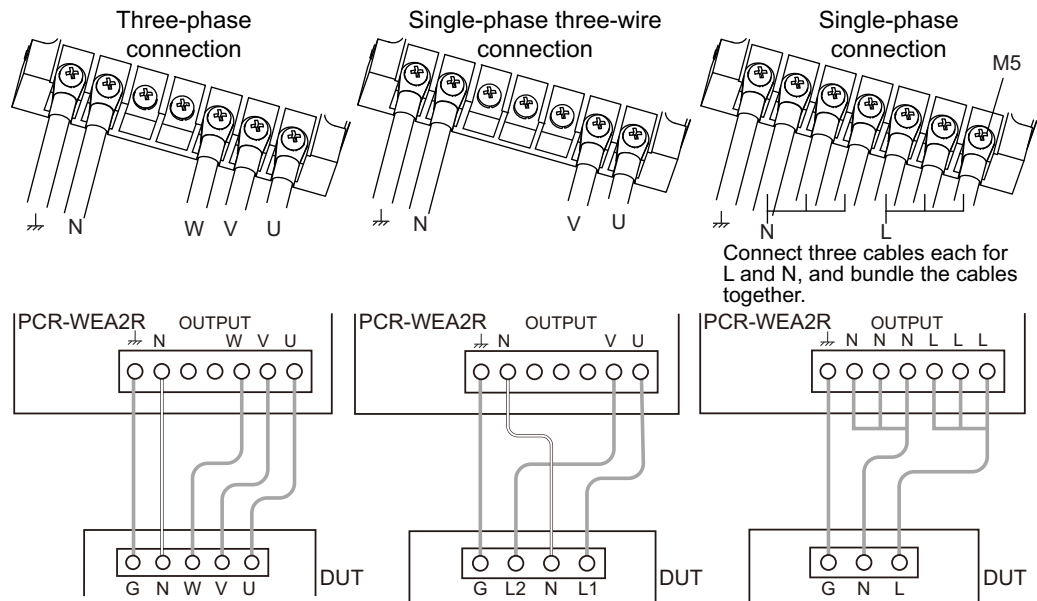


OUTPUT terminal cover

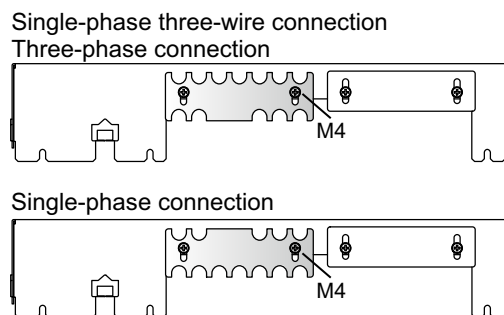
- 1** Turn off the output of the DUT and turn off (O) the POWER switch of the PCR-WEA.
- 2** Turn off the switchboard's circuit breaker.
- 3** Unfasten the five M4 screws from the terminal block cover, and remove the cover.



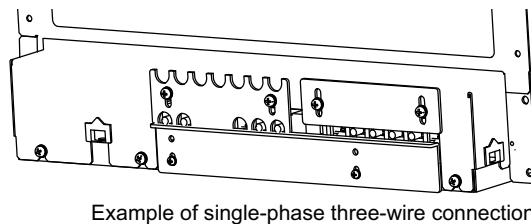
4 Securely connect the load cables to the OUTPUT (load input) terminal block.



5 Adjust the OUTPUT terminal cover so that the unused terminals are not exposed.



6 Fasten the terminal cover you removed in step 3 with the five screws.



7 Connect the load cables to the output terminals of the DUT.

This completes the connections.

Connection of PCR18000WEA2R/PCR24000WEA2R/PCR30000WEA2R/PCR36000WEA2R

In CC Load mode, the OUTPUT terminal of the PCR-WEA is used as the load input terminal.

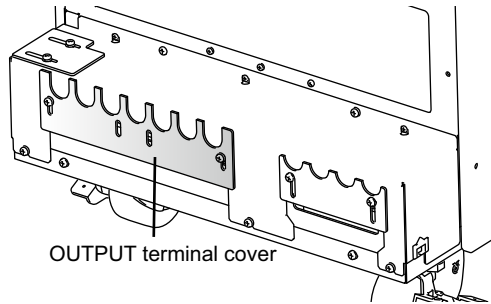
WARNING

Risk of electric shock.

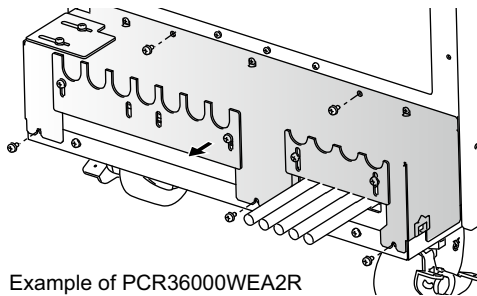
- Attach the OUTPUT terminal cover so that the terminals are not exposed according to the input system.
- To use single-phase input, be sure to connect three cables each for L and N. You may accidentally touch unused terminals through gaps in the OUTPUT (load input) terminal cover.

When the product is shipped from the factory, an OUTPUT terminal cover is attached to keep the OUTPUT terminals from becoming exposed.

If you are not using the OUTPUT terminal block, attach the terminal cover so that the terminals are not exposed.

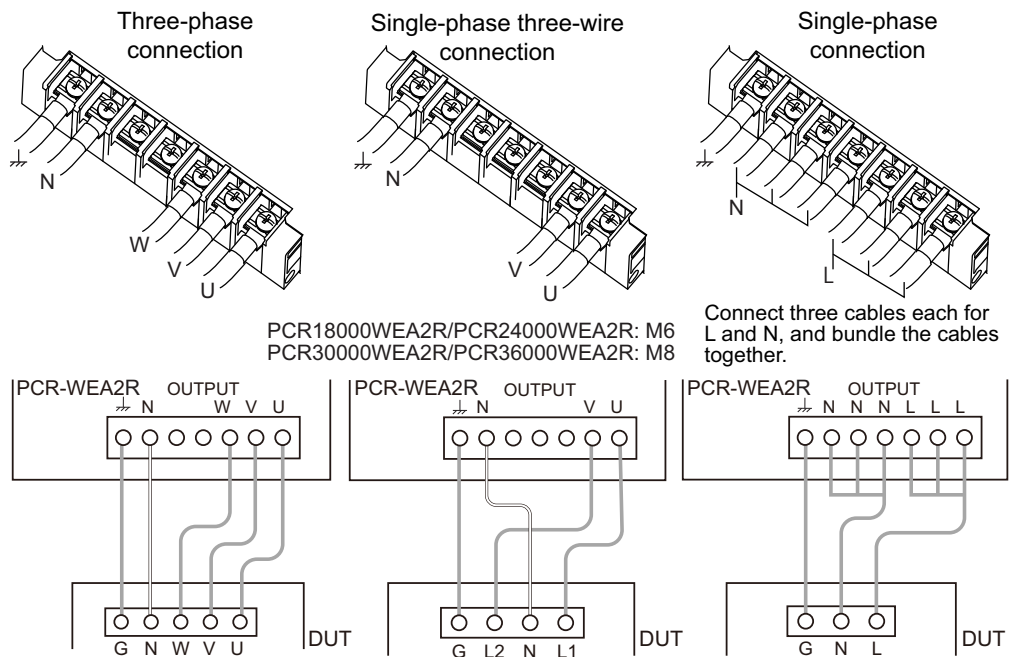


- 1 Turn off the output of the DUT and turn off (O) the POWER switch of the PCR-WEA.
- 2 Turn off the switchboard's circuit breaker.
- 3 Unfasten the five M4 screws from the terminal block cover, and remove the cover.

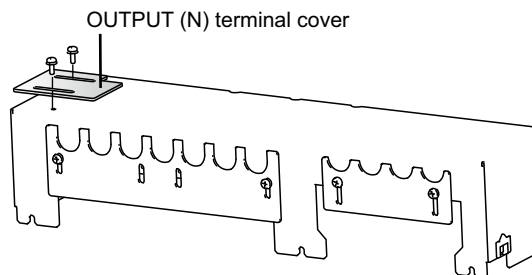


Example of PCR36000WEA2R

4 Securely connect the load cables to the OUTPUT (load input) terminal block.

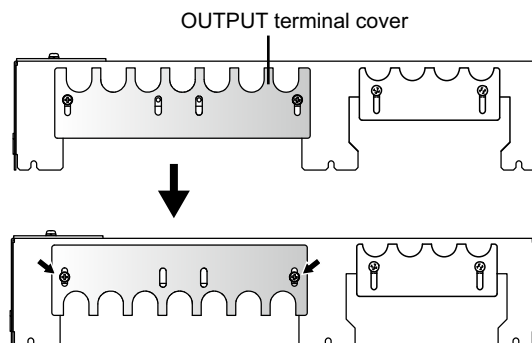


5 To use three-phase input or single-phase three-wire input, remove the OUTPUT (N) terminal cover from the terminal block cover.



6 Unfasten the two M4 screws from the OUTPUT terminal cover, change the orientation of the cover, and fasten with the screws you just removed.

Tighten the screws so that the OUTPUT terminal cover can still be moved.

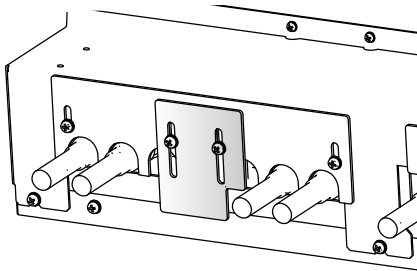


7 Fasten the terminal cover you removed in step 3 with the five screws.

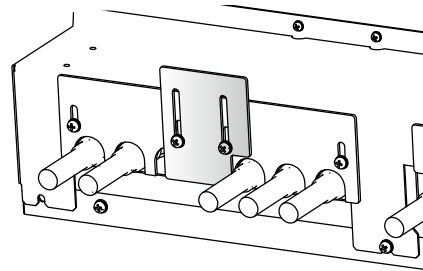
8 Slide the OUTPUT terminal cover until it touches the wires, and then fasten the screws.

- 9** To use three-phase input or single-phase three-wire input, attach the OUTPUT (N) terminal cover so that the unused terminals are not exposed.

Single-phase three-wire connection



Three-phase connection



- 10** Connect the load cables to the output terminals of the DUT.

This completes the connections.

Basic Functions

Panel Operation Basics

See “Panel Operation Basics” in the User’s Manual.

Selecting the wiring method

Select the wiring method (single-phase/single-phase three-wire/three-phase).

See “Selecting the Output Method” in the User’s manual.

Overvoltage protection (OVP) setting

The factory default setting for OVP, +PKOVP, and -PKOVP in CC Load mode is 14.0 V (or -14.0 V).

To change the OVP setting, see “Protection Functions” ([p.55](#)).

Sync settings

The sync function synchronizes the frequency and phase of an input current of the product with the frequency and phase of a designated sync signal [load input terminal*, external synchronization input signal (EXT SYNCHRO)].

*: If hard sensing is connected, those are synchronized with hard sensing.

When controlling with an external analog signal and the signal source is set to external only (EXT), and if the frequency is changed by a DC signal from an external source, the sync function is disabled.

To finely control the synchronization phase of the input voltage on three-phase input, set the synchronization delay phase angle.

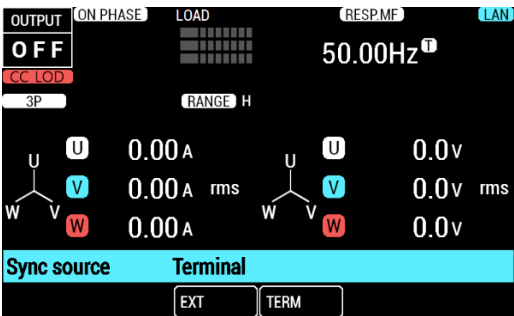
If a frequency lower than the frequency lower limit or higher than the frequency upper limit is input while synchronized, an alarm (ALM-20: SYNC ERR) will occur.

Selecting the input sync signal

You can select whether to synchronize with the load input terminal or the external synchronization input signal.

To synchronize with an external sync input signal (reference phase input), you need to set selectable I/O to SYNC CLK IN.

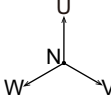
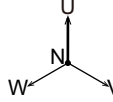
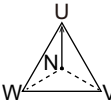
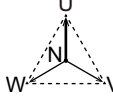
- 1 Press SYNC (SHIFT+9) > SOURCE (F5) to select the input sync signal.



Item	Title		Description
EXT (F3)	Sync source	External	Synchronizes with an external sync input signal
TERM (F4)		Terminal	Synchronizes with the voltage of the load input terminal (factory default setting).

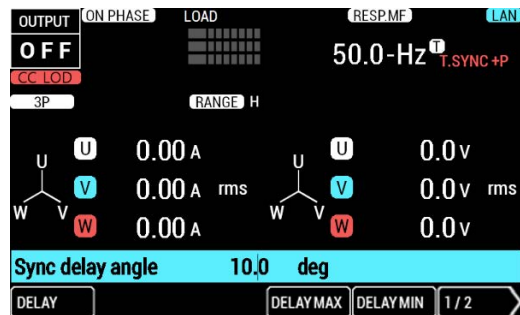
■ Phase

- External
Synchronizes with a signal input to DIGITAL I/O.
- Terminal

Wiring method	Phase to synchronize			
	1P	1P3W	3P	
	1P input		In-phase with the input	--
	1P3W input		In-phase with input V_{U-N}	--
	3P4W input	--		In-phase with the input
	3P3W input	--		In-phase with the input

Setting the synchronization delay phase angle

- 1** Press **SYNC (SHIFT+9) > DELAY (F4)** to set the synchronization delay phase angle.
The resolution is 0.1 deg.



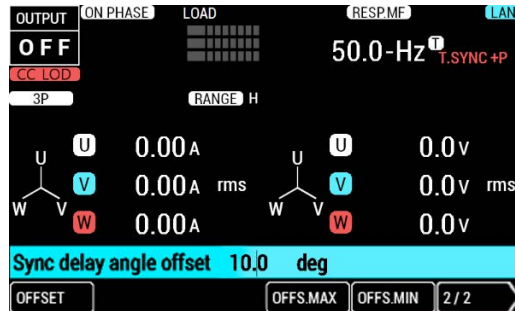
Item	Title	Description
DELAY (F4)	Sync delay angle	Sets the synchronization delay phase angle (-360.0 deg to 360.0 deg).

Setting the synchronization delay phase angle offset

To fine-tune the synchronization delay phase angle, set the synchronization delay phase angle offset.

- 1 Press SYNC (SHIFT+9) > DELAY (F4) > 1/2 (F6) > OFFSET (F1) to set the synchronization delay phase angle offset.

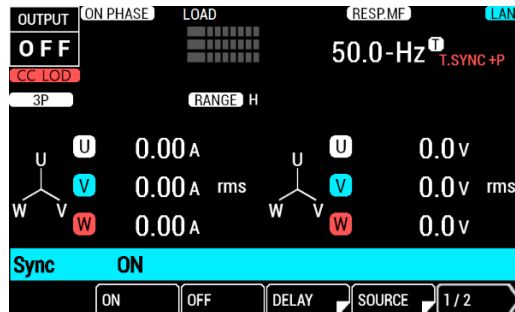
The resolution is 0.1 deg.



Item	Title	Description
OFFSET (F1)	Sync delay angle offset	Sets the synchronization delay phase angle offset (-360.0 to 360.0 deg).

Turning the sync function on and off

- 1 Press SYNC (SHIFT+9) to turn the sync function on and off.



Item	Title	Description
ON (F2)	Sync	Using the sync function (factory default setting) • If TERM is selected as the input sync signal T.SYNC¹ blinks until synchronization is established. When the frequency and the phase are synchronized after a few seconds, T.SYNC lights, and the synchronized frequency is displayed. • When the input sync signal is set to EXT EXT SYNC¹ blinks until synchronized. When the frequency and the phase are synchronized after a few seconds, EXT SYNC lights, and the synchronized frequency is displayed.
OFF (F3)		The synch function is disabled.

1. If the synchronization delay phase angle is set, +P (positive delay phase angle) or -P (negative delay phase angle) will also be displayed.

NOTE

- When the sync function is turned on and synchronized, the last digit of the frequency display is hidden. This is because the frequency value slightly fluctuates due to synchronization. For example, “50.00 Hz” is displayed as “50.0-Hz”, and “1000 Hz” is displayed as “100-Hz”.
 - In the following cases, synchronization will not be possible, and SYNC NG, T.SYNC NG, or EXT SYNC NG appears.
 - The voltage is below the detectable level.
 - The frequency of the applied voltage is outside the range of $F_{MIN} \leq x \leq F_{MAX}$.
 - The distortion or noise of the input voltage is extremely high.
-

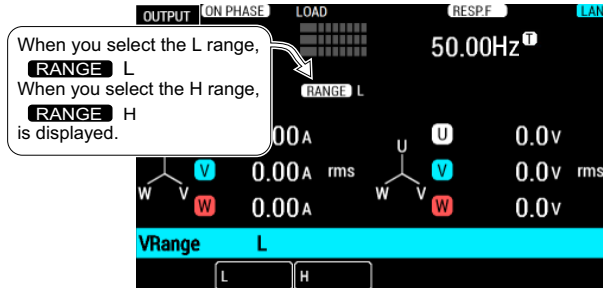
The frequency that is used when the sync function is cleared

If the frequency when the sync function is in use is within the frequency limit range, it is set to the synchronized frequency.

For example, if the applied voltage frequency is synchronized at 50 Hz, the main unit's panel will display “50.0-Hz”. If the sync function is released when the instantaneous synchronization frequency inside is “50.02 Hz”, “50.00 Hz” will be set as the final synchronized frequency, rounded to the last digit.

Setting the current value

Setting the voltage/current range



1 Press RANGE (SHIFT+8).

2 Select the range.

Since the range is based on voltage, the range of settable current is wider in the L range and narrower in the H range.

Item	Title	Description
L (F2)	VRange	Set to L range (factory default setting)
H (F3)		Set to H range

Current setting range

Power capacity	Range	AC current (Arms)		DC current (A)	
		1P	1P3W/3P	1P	1P3W/3P
6 kVA	L range	0.00 to 66.00	0.00 to 22.00	-66.00 to 66.00	-22.00 to 22.00
	H range	0.00 to 33.00	0.00 to 11.00	-33.00 to 33.00	-11.00 to 11.00
12 kVA	L range	0.00 to 132.00	0.00 to 44.00	-132.00 to 132.00	-44.00 to 44.00
	H range	0.00 to 66.00	0.00 to 22.00	-66.00 to 66.00	-22.00 to 22.00
18 kVA	L range	0.00 to 198.00	0.00 to 66.00	-198.00 to 198.00	-66.00 to 66.00
	H range	0.00 to 99.00	0.00 to 33.00	-99.00 to 99.00	-33.00 to 33.00
24 kVA	L range	0.00 to 264.00	0.00 to 88.00	-264.00 to 264.00	-88.00 to 88.00
	H range	0.00 to 132.00	0.00 to 44.00	-132.00 to 132.00	-44.00 to 44.00
30 kVA	L range	0.00 to 330.00	0.00 to 110.00	-330.00 to 330.00	-110.00 to 110.00
	H range	0.00 to 165.00	0.00 to 55.00	-165.00 to 165.00	-55.00 to 55.00
36 kVA	L range	0.00 to 396.00	0.00 to 132.00	-396.00 to 396.00	-132.00 to 132.00
	H range	0.00 to 198.00	0.00 to 66.00	-198.00 to 198.00	-66.00 to 66.00

Reference: Voltage ranges

Range	AC voltage	DC voltage
L range	0.0 V to 161.0 V	-227.5 V to +227.5 V
H range	0.0 V to 322.0 V	-455.0 V to +455.0 V

⚠ CAUTION

Risk of damage to this product.

If the DUT's output voltage exceeds the voltage range of the L range, use the H range.

NOTE

- If there are power modules that are paused by the power module management function, the current setting range of the range is changed according to the number of power modules (power capacity) that are running.
 - If you change the power module management settings, the range will change to the factory default setting (L range).
-

3 Press ENT.

After switching the range, the system will be in a busy state for approximately 0.6 seconds.
The range setting is complete.

Setting the current value

NOTE

For AC + DC input, a current with a waveform where AC is superimposed on DC (or vice versa) is input. In this case, the total of configurable AC and DC current values is limited.

Set them to meet the following conditions:

$$(\text{AC current setting}) \times \sqrt{2} + |\text{DC current setting}| \leq (\text{rated current}) \times 110 \% \times \sqrt{2}$$

Rated currents vary depending on models (power capacity), wiring methods (single-phase / single-phase three-wire / three-phase), and L/H ranges.

For details, see Specifications [\(p.213\)](#).

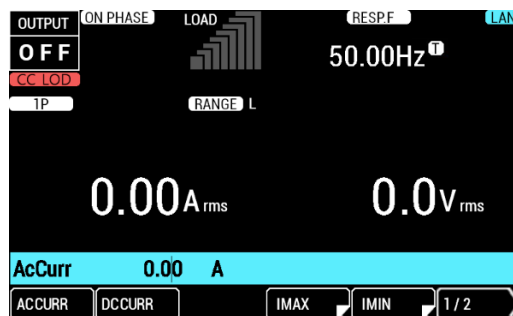
■ Single-phase two-wire: 1P2W

1 Set the current value using the procedure below.

AC/DC	Setup procedure
AC	I > AC CURR (F1)
DC	I > DC CURR (F2)

The current setting range varies depending on the model and the selected range.

See “Setting range” in the “Output” [\(p.214\)](#) section of the “Specifications” part.



■ Single-phase three-wire (1P3W)

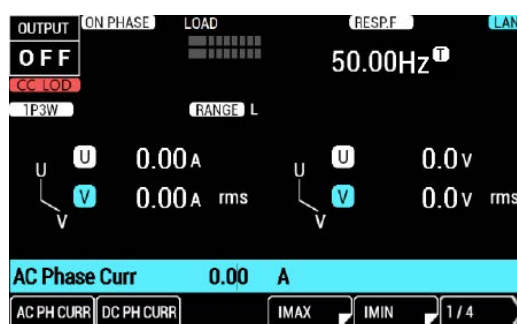
1 Set the current value using the procedure below.

If the phases have different current settings, the unbalance icon will appear. [\(p.37\)](#)

AC/DC	Phase to set	Setup procedure
AC	All phases	I > AC PH CURR (F1)
	U-phase	I > 1/4 (F6) > U AC CURR (F1)
	V-phase	I > 1/4 (F6) > V AC CURR (F2)
DC	All phases	I > DC PH CURR (F2)
	U-phase	I > 1/4 (F6) > 2/4 (F6) > U DC CURR (F1)
	V-phase	I > 1/4 (F6) > 2/4 (F6) > V DC CURR (F2)

The current setting range varies depending on the model and the selected range.

See “Setting range” in the “Output” [\(p.214\)](#) section of the “Specifications” part.



Example when all phases are selected in AC

■ Three-phase (3P)

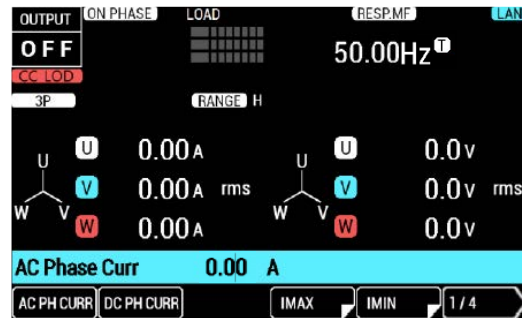
1 Set the current value using the procedure below.

If the phases have different current settings, the unbalance icon will appear. (p.37)

AC/DC	Phase to set	Setup procedure
AC	All phases	I > AC PH CURR (F1)
	U-phase	I > 1/4 (F6) > U AC CURR (F1)
	V-phase	I > 1/4 (F6) > V AC CURR (F2)
	W-phase	I > 1/4 (F6) > W AC CURR (F3)
DC	All phases	I > DC PH CURR (F2)
	U-phase	I > 1/4 (F6) > 2/4 (F6) > U DC CURR (F1)
	V-phase	I > 1/4 (F6) > 2/4 (F6) > V DC CURR (F2)
	W-phase	I > 1/4 (F6) > 2/4 (F6) > W DC CURR (F3)

The current setting range varies depending on the model and the selected range.

See "Setting range" in the "Output" (p.214) section of the "Specifications" part.



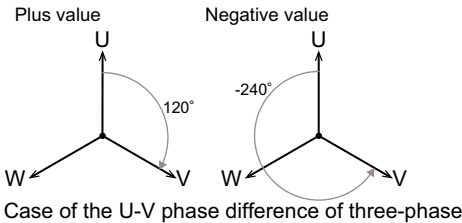
Example when all phases are selected in AC

Setting the current phase difference

The current phase difference is set.

The setting can be designated in either plus or minus phase.

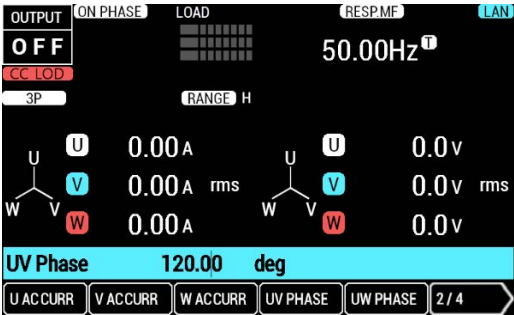
If the U-V phase difference is set to $+120^\circ$ or -240° , for example, those are the same difference (120°) and the product operates in the same way for both cases as a result.



■ U-V phase difference

1 Press **I > 1/4 (F6) > UV PHASE (F4)** to set the phase difference.

If an unbalanced phase difference is set, the unbalance icon will appear. [\(p.37\)](#)

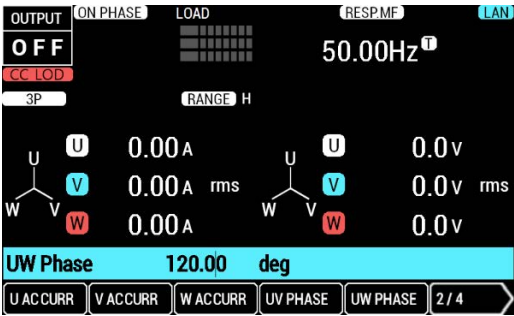


Item	Title	Description
UV PHASE (F4)	UV Phase	Setting the U-V phase difference (-360.00 to 360.00 deg). Factory default: • 180.00 deg (1P3W) • 120.00 deg (3P)

■ U-W phase difference

1 Press **I > 1/4 (F6) > UW PHASE (F5)** to set the phase difference.

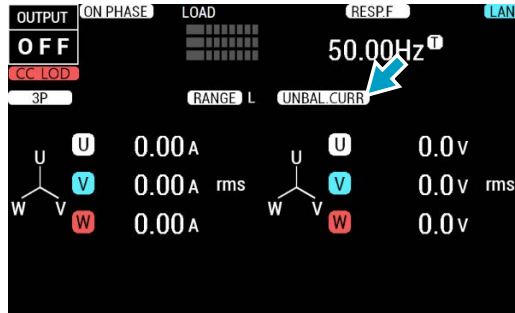
If an unbalanced phase difference is set, the unbalance icon will appear. [\(p.37\)](#)



Item	Title	Description
UW PHASE (F5)	UW Phase	Setting the U-W phase difference (-360.00 to 360.00 deg). Factory default: • 270.00 deg (3P)

Specifying unbalance

If you set each phase to different currents or resistance values, or set the phase difference to unbalanced, the unbalance icon appears.



Output	Phase difference		Current of each phase	Resistance of each phase	Display
	U-V	U-W			
Output	Other than 180°	--	Same	Same	UNBAL.PHAS
	180°	--	Different	Same	UNBAL.CURR
	180°	--	Same	Different	UNBAL.RES
	Other than 180°	--	Different	Same	UNBAL.PHAS,CURR
	180°	--	Different	Different	UNBAL.CURR,RES
	Other than 180°	--	Same	Different	UNBAL.PHAS,RES
	Other than 180°	--	Different	Different	UNBAL.PHAS,CURR,RES
3P	Other than 120° ¹	Other than 240° ¹	Same	Same	UNBAL.PHAS
	120°	240°	Different	Same	UNBAL.CURR
	120°	240°	Same	Different	UNBAL.RES
	Other than 120° ¹	Other than 240° ¹	Different	Same	UNBAL.PHAS,CURR
	120°	240°	Different	Different	UNBAL.CURR,RES
	Other than 120° ¹	Other than 240° ¹	Same	Different	UNBAL.PHAS,RES
	Other than 120° ¹	Other than 240° ¹	Different	Different	UNBAL.PHAS,CURR,RES

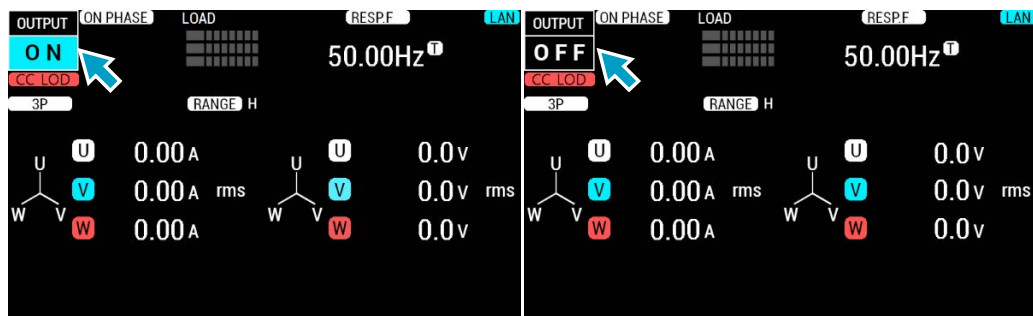
1. If either the "U and V" or "U and W" condition applies, the configuration is considered unbalanced.

Load on/off

The state in which current is flowing through the PCR-WEA is called “load on”. Conversely, the state in which no current is flowing is called “load off”. You can turn the PCR-WEA load on and off using the OUTPUT key.

1 Press OUTPUT key.

Each press of the OUTPUT key toggles between load on/load off.



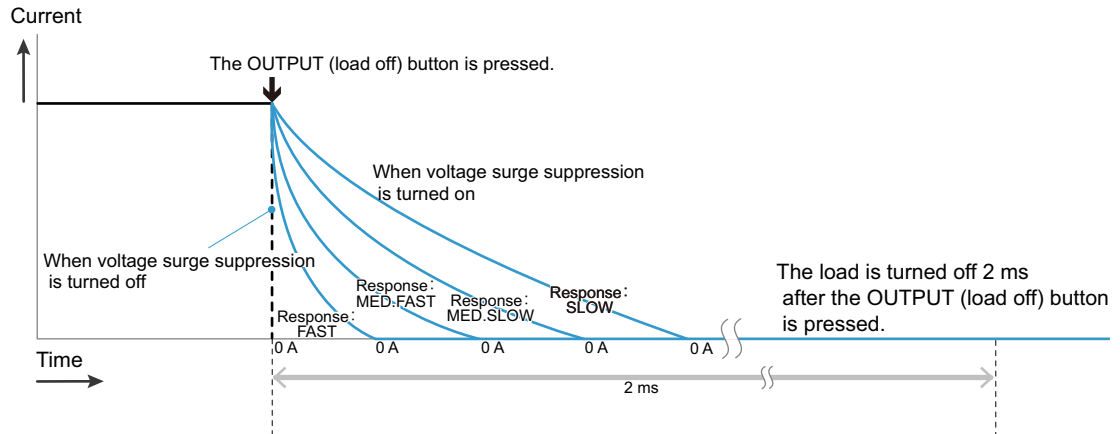
Voltage surge suppression when the load is turned off

You can set the voltage surge suppression that is activated when the load is turned off.

If voltage surge suppression is turned on, a current is controlled to 0 A when OUTPUT is turned off (load off) and this state is kept for about 2 ms after the OUTPUT button is pressed.

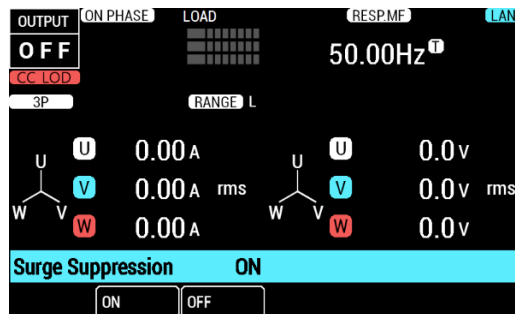
A voltage surge immediately after the load is turned off can be suppressed in this way.

Note that a fall time until a current drops to 0 A varies depending on the response setting.



If the voltage surge suppression function is off, "OUTPUT*" is displayed.

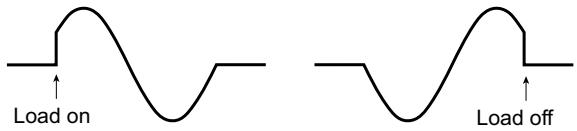
- 1 Press CONFIG (SHIFT+OPR MODE) > 1/3 (F6) > SURGE S (F2) to set the voltage surge suppression.



Item	Title	Description
ON (F2)	Surge suppression	Voltage surge suppression on
OFF (F3)		Voltage surge suppression off

Load on/off phase control

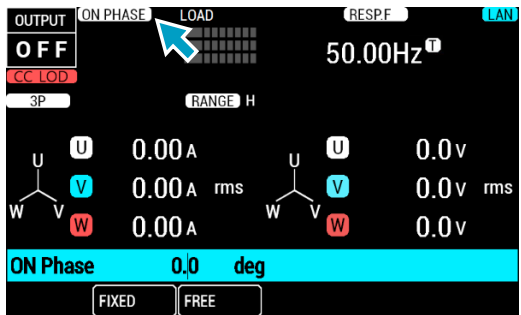
You can set the load-on and load-off phases separately for AC input.
For single-phase three-wire output and three-phase output, set the U-phase.



■ Load on phase setup procedure

When you are controlling the load-on phase, set the phase angle as well.
If the load-on phase is set, "ON PHASE" is displayed.
See notes for inrush current (p.8) to set it.

1 Press ON PHASE (SHIFT+7) to set the load-on phase.



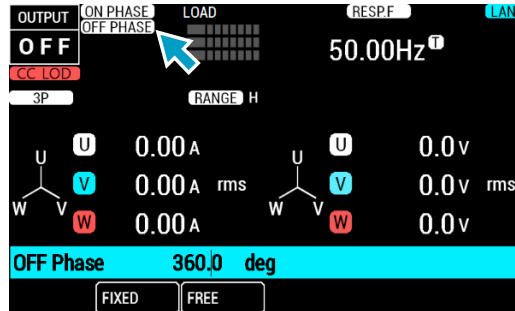
Item	Title	Description
FIXED (F2)	ON Phase	Enables load-on phase control (factory default setting) Sets the load-on phase angle (0.0 deg to 360.0 deg). 0.0 deg = 360.0 deg
FREE (F3)		The load-on phase is not controlled.

■ Load off phase setup procedure

When you are controlling the load-off phase, set the phase angle as well.

If the load-off phase is set, "OFF PHASE" is displayed.

1 Press OFF PHASE (SHIFT+4) to set the load-off phase.



Item	Title	Description
FIXED (F2)	OFF Phase	Enables load-off phase control Sets the load-off phase angle (0.0 deg to 360.0 deg). 0.0 deg = 360.0 deg
FREE (F3)		The load-off phase is not controlled.

AC coupling

This product inputs the internally generated AC signal (AC REF) directly into the DC amplifier. Therefore, the DC component included in the AC REF signal is also amplified and output.

This function is effective when amplifying the voltage of an external analog input and outputting only the AC current.

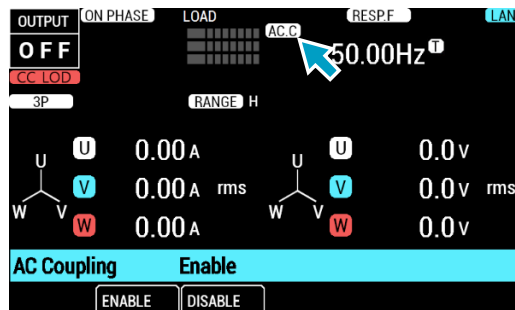
When a voltage containing a DC component that should not be reflected in the output is applied to the external analog input, enabling this function allows AC coupling.

Because the amplifier is AC coupled, the output voltage is reduced slightly in the low frequency range.

The frequency response is within $\pm 1\%$ in the 40 Hz to 999.9 Hz range with 200 Hz as the reference.

When AC coupling is enabled, "AC.C" is displayed.

1 Press OPR MODE > ACC.COUP (F1) to set AC coupling.



Item	Title	Description
ENABLE (F2)	AC Coupling	Enables AC coupling
DISABLE (F3)		Disables AC coupling (factory default)

Measurement display

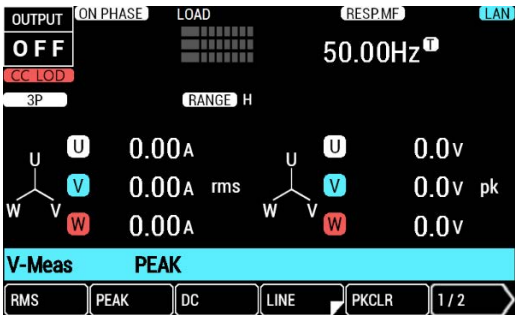
You can monitor the present input value.

Displaying the voltage

The measured voltage is displayed in the status, measured-value, and setting display area.
You can select whether to display the rms, peak, or average voltage.

Switching display items

- 1 Press the V-MEAS (SHIFT+V) key to switch the voltage display.



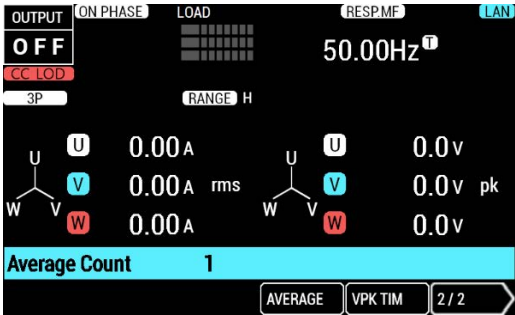
Item	Title	Unit	Description
RMS (F1)	V-Meas	V rms	Displays the rms voltage
PEAK (F2)		V pk	Displays the peak voltage
DC (F3)		V dc	Displays the average voltage
LINE ¹ (F4)	ON (F2)	V-Line	Displays the line voltage
	OFF (F3)		Displays the phase voltage

1. Only for single-phase three-wire and three-phase settings

Averaging voltage measurements

You can average the rms-voltage and average-voltage measurements and display the result.

- 1 Press V-MEAS (SHIFT+V) > 1/2 (F6) > AVERAGE (F4) to set voltage value averaging.

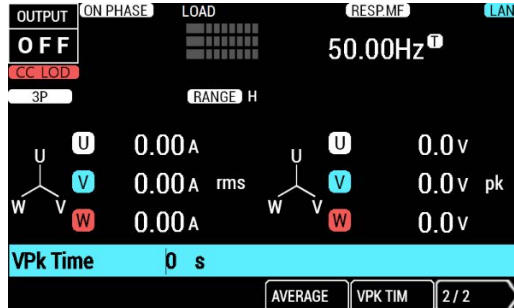


Item	Title	Description
AVERAGE (F4)	Average Count	Values will be averaged. Average count (moving average): 1 to 32

■ Holding the peak voltage

If the measurement display is set to peak voltage, the peak voltage can be held.

- 1 Press V-MEAS (SHIFT+V) > 1/2 (F6) > VPK TIM (F5) to set the hold time.



Item	Title	Description
VPK TIM (F5)	VPk Time	Sets the hold time (0 s to 10 s or ∞). If you use the numeric key pad to specify a value that is greater than or equal to 11, infinity (∞) will be specified.

■ Clearing the peak voltage

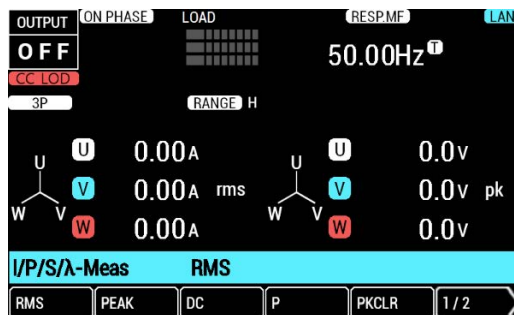
- 1 Press V-MEAS (SHIFT+V) > PKCLR (F5) to clear the peak voltage.

Displaying the current, power, and power factor

You can select which value to display normally in the status, measured-value, and setting display area from rms current, peak current, average current, power, apparent power, and power factor.

■ Switching display items

- 1 Press the I/P/S/λ-MEAS (SHIFT+I) key to switch the display.



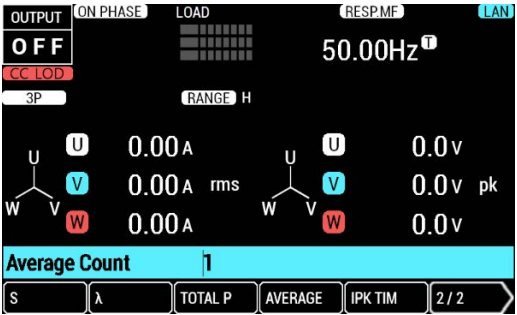
Item	Title	Unit	Description
RMS (F1)	I/P/S/λ-Meas	A rms	Displays the rms current
PEAK (F2)		A pk	Displays the peak current
DC (F3)		A dc	Displays the average current
P (F4)		W/kW	Displays the power
1/2 (F6) > S (F1)		VA/kVA	Displays the apparent power
1/2 (F6) > λ (F2)		λ	Displays the power factor
1/2 (F6) > TOTAL ¹ (F3)		W/kW	Displays the total power

1. 単相 3 線設定時と三相設定時のみ

■ Averaging current and power measurements

You can display the averaged measurements of rms currents, average currents, power values, apparent power values, and power factors.

- 1 Press I/P/S/λ-MEAS (SHIFT+I) > 1/2 (F6) > AVERAGE (F4) to set current value averaging, power value, and power factor value averaging.

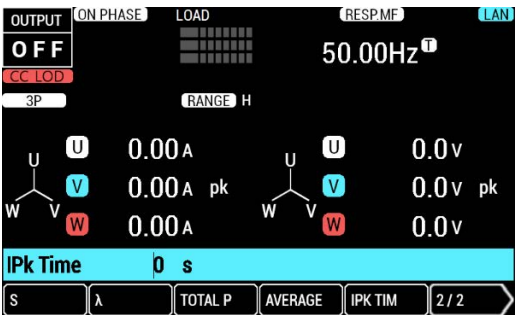


Item	Title	Description
AVERAGE (F4)	Average Count	Values will be averaged. Average count (moving average): 1 to 32

■ Holding the peak current

The peak current is displayed as an absolute value of the maximum instantaneous current measured. Even if a negative DC voltage is input, the peak current value is displayed with positive polarity. If the measurement display is set to peak current, the peak current can be held.

- 1 Press I/P/S/λ-MEAS (SHIFT+I) > 1/2 (F6) > IPK TIM (F5) to set the hold time.



Item	Title	Description
IPK TIM (F5)	IPk Time	Sets the hold time (0 s to 10 s or ∞). If you use the numeric key pad to specify a value that is greater than or equal to 11, infinity (∞) will be specified.

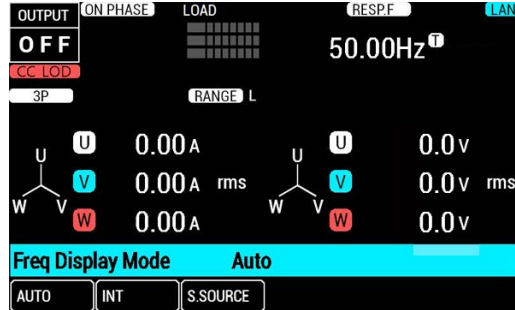
■ Clearing the peak current

- 1 Press I/P/S/λ-MEAS (SHIFT+I) > PKCLR (F5) to clear the peak current.

Frequency display

Select the type of frequency to display.

1 Press F > F.DISP (F2) to switch the type of frequency displayed.



Item	Title	Sync function	Input sync signal	Description	Displayed icon
AUTO (F1)	Freq Display Mode	OFF	EXT/TERM	Input frequency setting	
		ON	EXT	Measured frequency value (EXT input)	
			TERM	Measured frequency value (TERM input)	
INT (F2)		ON/OFF	EXT/TERM	Input frequency setting	
S.SOURCE (F3)		ON/OFF	EXT	Measured frequency value (EXT input)	
			TERM	Measured frequency value (TERM input)	

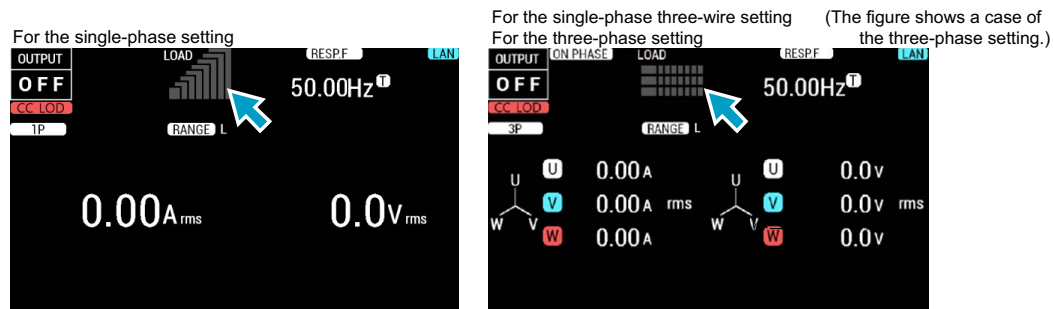
LOAD level meter

The LOAD level meter detects input current and displays the percentage of the input current relative to the rated current in a bar graph.

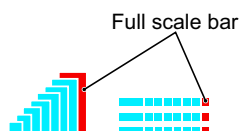
The full scale of the LOAD level meter is 1.1 times the rated current or the input overcurrent protection (OCP) setting, whichever is less.

For the single-phase three-wire setting, the U-phase and V-phase are displayed in this order from the top.

For the three-phase setting, the U-phase, V-phase, and W-phase are displayed in this order from the top.



The full scale bar (the right-most bar that lights red) of the LOAD level meter lights on the verge of an overload.



When the PCR-WEA is on the verge of an overload, the internal temperature increases. Even if the load is reduced, the full scale bar may continue to light dimly in red. When cooling is complete, the full scale bar turns off.

If an overload occurs repeatedly while the full-scale bar is lit, an alarm (ALM-06: OVERLOAD) may be triggered.

Limit Functions and Protection Functions

This product has the following limit functions and protection functions.

- Limit functions

These set limits on this product's settings to prevent damage to the product and DUT from incorrect operation, or to limit the current flow. It allows you to set limit values according to the DUT conditions.

- Protection Functions

These protect the DUT when abnormal input occurs in the internal circuit of this product.

If a protection function is activated, an alarm (ALM-xx) or a trouble indication (TRBL-xx) is generated and the load is turned off.

Item	Function	Description	Load off
Upper current limit Lower current limit	Limit	After you set the current limits, you can no longer specify current values outside the limit range.	No
Upper frequency limit Lower frequency limit	Limit	After you set the frequency limits, you will no longer be able to specify frequency values outside the range.	No
Upper resistance limit Lower resistance limit	Limit	After you set the resistance limits, you can no longer specify CR resistance values outside the limit range.	No
Upper limit of synchronization delay phase angle Lower limit of synchronization delay phase angle	Limit	After you set the limit values of synchronization delay phase angle, you can no longer specify synchronization delay phase angle values outside the limit range.	No
Upper limit of synchronization delay phase angle offset Lower limit of synchronization delay phase angle offset	Limit	After you set the limit values of synchronization delay phase angle offset, you can no longer specify synchronization delay phase angle offset values outside the limit range.	No
Input overcurrent protection(OCP)	Protection	Any current exceeding the upper limit turns off the load. You cannot set the lower limit.	Yes
Input overvoltage protection(OVP)	Protection	If the measured voltage exceeds the OVP value, an alarm occurs, and the load turns off.	Yes
Input undervoltage protection(UVP)	Protection	If the measured voltage falls below the UVP value, an alarm occurs, and the load turns off.	Yes
Source Voltage drop protection (AC INPUT LOW)	Protection	If the input voltage of the AC power line drops below the rated value, a trouble indication occurs and the load turns off.	Yes
Overload protection(OVERLOAD)	Protection	If the input current exceeds the rated current or current limit, an alarm occurs, and the load turns off.	Yes
Overheat protection(OHP)	Protection	If the internal temperature increases abnormally, an alarm occurs, and the load turns off.	Yes

Limit functions

Upper and lower current limits

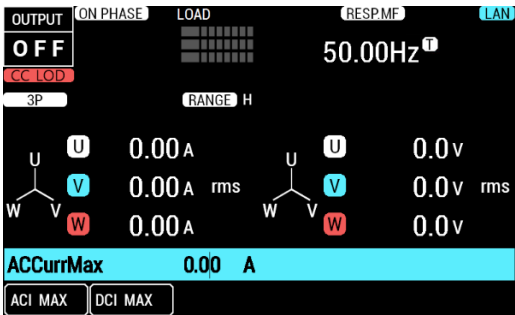
After you set the current limits, you can no longer specify current values outside the limit range.
Set the limits so that the lower limit is less than or equal to the upper limit.
There are AC limits and DC limits. Check the title in the entry area, and then set the value.

NOTE

- If there are power modules that are paused by the power module management function, the limit setting range is changed according to the number of power modules (power capacity) that are running.
- When the power module management setting is changed, the limit values are reset to factory default settings.

■ Setting the upper limit value

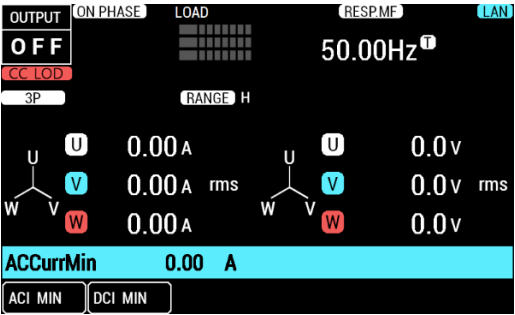
1 Press **I > IMAX (F4)** to set the upper limit value.



Item	Title	Description
ACI MAX (F1)	ACCurrMax	Sets the upper limit value of AC current (0 A to maximum current setting value). Factory default: 110 % of the rated current
DCI MAX (F2)	DCCurrMax	Sets the upper limit value of DC current (minimum to maximum current setting value). Factory default: 110% of the rated current

■ Setting the lower limit values

1 Press I > IMIN (F5) to set the lower limit value.



Item	Title	Description
ACI MIN (F1)	ACCurrMin	Sets the lower limit value of AC current (0 A to maximum current setting value). Factory default setting: 0 A
DCI MIN (F2)	DCCurrMin	Sets the lower limit value of DC current (minimum to maximum current setting value). Factory default: 110 % of negative rated current

Upper and lower frequency limits

After you set the frequency limits, you will no longer be able to specify frequency values that are outside of the range that you have set.

Set the limits so that the lower limit is less than or equal to the upper limit.

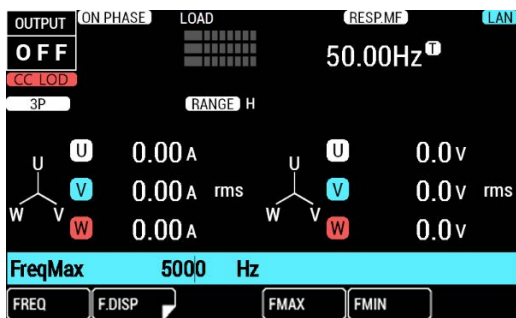
If the sync function is on, any frequency outside the limit turns off the load. The load cannot be turned on either.

Limits apply to all phases for single-phase three-wire setting and the three-phase setting.

On the 500 Hz limit model, the upper frequency limit is set to 500.0 Hz only for the three-phase setting.

■ Setting the upper limit value

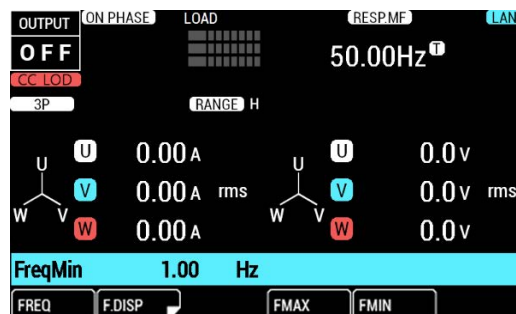
1 Press F > FMAX (F4) to set the upper limit value.



Item	Title	Description
FMAX (F4)	FreqMax	Sets the upper frequency limit (1.00 Hz to 5000 Hz). Factory default setting: 65.00 Hz

■ Setting the lower limit values

1 Press F > FMIN (F5) to set the lower limit value.



Item	Title	Description
FMIN (F5)	FreqMin	Sets the lower frequency limit (1.00 Hz to 5000 Hz). Factory default: 45.00 Hz

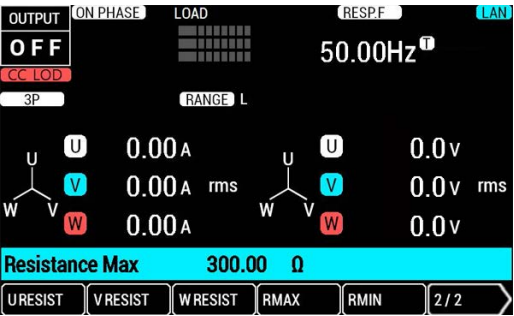
Upper and lower resistance limits

After you set the resistance limits, you can no longer specify CR resistance values outside the limit range.
Set the limits so that the lower limit is less than or equal to the upper limit.

■ Setting the upper limit value

1 Set the upper limit value using the following procedure:

Connection method	Setup procedure
1P	$I > 1/2 (F6) > CR (F4) > 1/2 (F6) > RMAX (F4)$
1P3W	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > RMAX (F4)$
3P	



Item	Title	Description
RMAX (F4)	Resistance Max	Sets the upper limit value of the CR resistance.

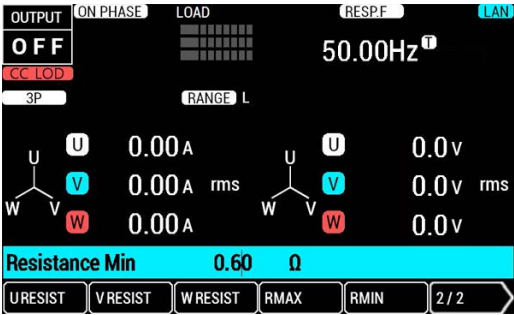
The setting range and factory default settings vary depending on the number of operating power modules (power capacity), wiring method, and selected range.

- Setting Range: See the “Output” (p.214) section of the “Specifications” part.
- Factory default settings: See “Panel settings” (p.206)

■ Setting the lower limit values

1 Set the lower limit value using the following procedure:

Connection method	Setup procedure
1P	$I > 1/2 (F6) > CR (F4) > 1/2 (F6) > RMIN (F5)$
1P3W	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > RMIN (F5)$
3P	



Item	Title	Description
RMIN (F5)	Resistance Min	Sets the lower limit value of CR resistance.

The setting range and factory default settings vary depending on the number of operating power modules (power capacity), wiring method, and selected range.

- Setting Range: See the “Output” (p.214) section of the “Specifications” part.
- Factory default settings: See “Panel settings” (p.206)

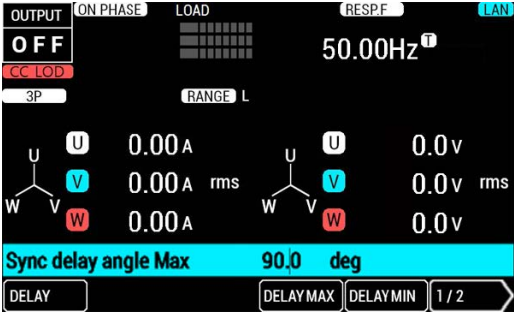
Upper and lower limits of synchronization delay phase angle

After you set the limit values of synchronization delay phase angle, you can no longer specify synchronization delay phase angle values outside the limit range.

Set the limits so that the lower limit is less than or equal to the upper limit.

■ Setting the upper limit value

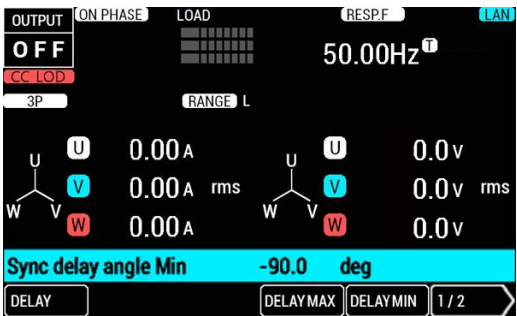
1 Press SYNC (SHIFT+9) > DELAY (F4) > DELAY MAX (F4) to set the upper limit value.



Item	Title	Description
DELAY MAX (F4)	Sync delay angle Max	Sets the upper limit value of the synchronization delay phase angle (-360.0 to 360.0 deg). Factory default: 90.00 deg.

■ Setting the lower limit values

1 Press SYNC (SHIFT+9) > DELAY (F4) > DELAY MIN (F5) to set the lower limit value.



Item	Title	Description
DELAY MIN (F5)	Sync delay angle Min	Sets the lower limit value of the synchronization delay phase angle (-360.0 to 360.0 deg). Factory default: -90.00 deg.

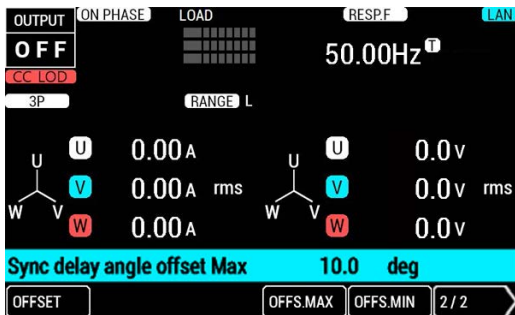
Upper and lower limits of synchronization delay phase angle offset

After you set the limit values of the synchronization delay phase angle offset, you can no longer specify synchronization delay phase angle offset values outside the limit range.

Set the limits so that the lower limit is less than or equal to the upper limit.

Setting the upper limit value

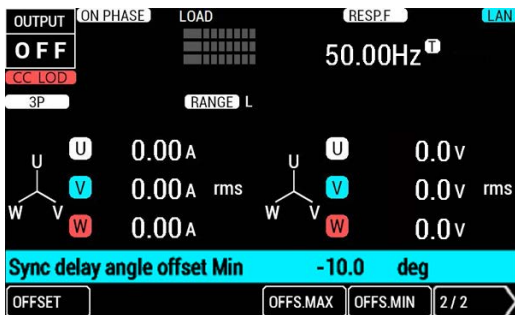
- 1 Press SYNC (SHIFT+9) > DELAY (F4) > 1/2 (F6) > OFFS MAX (F4) to set the upper limit value.



Item	Title	Description
OFFS MAX (F4)	Sync delay angle offset Max	Sets the upper limit value of the synchronization delay phase angle offset (-360.0 to 360.0 deg). Factory default: 10.0 deg.

Setting the lower limit values

- 1 Press SYNC (SHIFT+9) > DELAY (F4) > 1/2 (F6) > OFFS MIN (F5) to set the lower limit value.



Item	Title	Description
OFFS MIN (F5)	Sync delay angle offset Min	Sets the lower limit value of the synchronization delay phase angle offset (-360.0 to 360.0 deg). Factory default: -10.0 deg.

Protection Functions

Clearing alarms

Press ALM CLR (SHIFT+CLR) to clear the alarm, and then fix the problem that caused the alarm.

If an alarm still occurs even after you have corrected all the causes of alarms, the product may be malfunctioning.

Stop using it immediately, and contact your Kikusui agent or distributor.

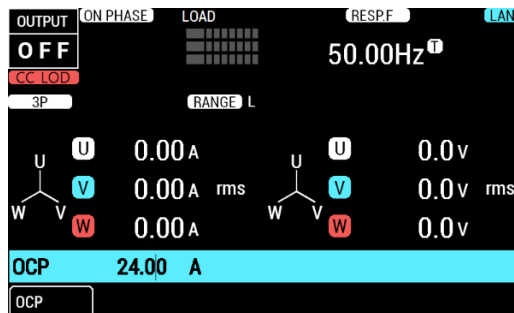
Input overcurrent protection (OCP)

If an input current exceeds the OCP setting (rms) continuously for approximately 100 to 200 ms, OCP will be activated.

An alarm (ALM-06: OVERLOAD) will be generated.

1 Set the OCP value using the following procedure:

Connection method	Setup procedure
1P	$I > 1/2 (F6) > \text{PROTECT (F3)} > \text{OCP (F1)}$
1P3W	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > \text{PROTECT (F3)} > \text{OCP (F1)}$
3P	



Item	Title	Description
OCP (F1)	OCP	Sets the OCP value (10% to 120% of rated current of L range). The factory default setting is 120% of rated current of L range.

⚠ CAUTION

Risk of malfunction.

If an overload occurs, be sure to remove the cause of the problem, and then press OUTPUT (LOAD ON).

Input overvoltage protection (OVP)

If the measured voltage exceeds the OVP setting (rms) continuously for approximately 100 to 200 ms, OVP will be activated.

If the peak measured voltage exceeds the peak OVP setting continuously for the set trip time (configurable between 20 to 5020 μ s), in addition, OVP will be activated.

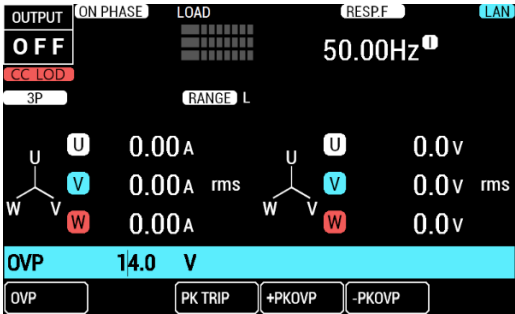
If OVP is activated, an alarm (ALM-00: OVP) will occur.

NOTE

For internal protection, if the applied voltage exceeds the L range: ± 270 Vpk or the H range: ± 540 Vpk, overvoltage protection (OVP) will be activated regardless of the set OVP value and the trouble (TRBL-40-XX: OOS OVP) will appear.

■ OVP setting

1 Press **V > PROTECT (F3) > OVP (F1)** to set the OVP value.

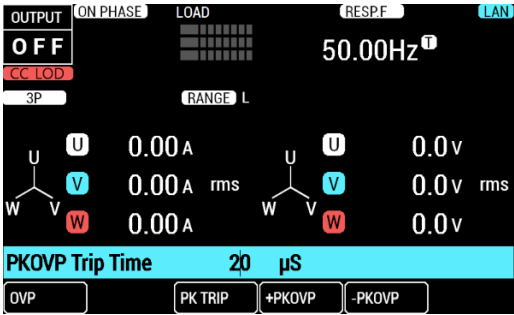


Item	Title	Description
OVP (F1)	OVP	Sets the OVP Value (14.0 to 500.5 V rms).
+PKOVP (F4)	+PKOVP	Sets the positive peak OVP value (14.0 V to 500.5 V).
-PKOVP (F5)	-PKOVP	Sets the negative peak OVP value (-500.5 V to -14.0 V).

■ Setting the peak OVP value (trip time)

You can set the time until the load turns off when the value is outside the range between the positive and negative peak OVP values.

- 1 Press **V > PROTECT (F3) > OVP (F1) > PK TRIP (F3)** to set the trip time for the peak OVP value.



Item	Title	Description
PK TRIP	PKOVP Trip Time	Sets the time (20 μs to 5020 μs) until the load is turned off when a peak OVP value is exceeded. (The resolution is 100 μs)

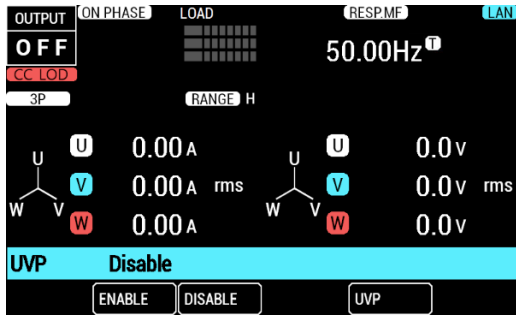
Input undervoltage protection (UVP)

If the measured voltage drops below the UVP setting continuously for approximately 100 to 200 ms, UVP will be activated. An alarm (ALM-07: UVP) will be generated.

You can enable or disable UVP detection.

■ UVPsetting

1 Press **V > PROTECT (F3) > UVP (F2)** to set the UVP.



Item	Title	Description
ENABLE (F2)	UVP	Enables UVP.
DISABLE (F3)		Disables UVP. This is the default setting.
UVP (F5)		Sets the UVP Value (0.0 to 500.5 V rms).

Input voltage drop protection (AC INPUT LOW)

If the AC power line input voltage drops below the rated value, input voltage drop protection will be activated. Adjust the input voltage so that it is within the range in the specifications. If the input power supply wiring is long, use wires that have a large diameter to make the voltage drops smaller.

If the input voltage drops below the rating but recovers within 3 seconds, an alarm (ALM-29: AC INPUT LOW) will be generated.

If the input voltage continuously drops below the rated value, a trouble indication (TRBL-29: AC INPUT LOW) will be generated.

Turn off the POWER switch, and eliminate the cause of the alarm. If the trouble indication is generated again when you turn on the POWER switch, stop using the product immediately, and contact your Kikusui agent or distributor to request repairs.

Overload protection (OVERLOAD)

If the input current exceeds the rated current or the current limit value, overload protection will be activated and an alarm (ALM-06: OVERLOAD) will be generated.

Press ALM CLR (SHIFT+CLR) to clear the alarm, and then fix the problem that caused the alarm.

Pressing the OUTPUT key again turns on the load.

Overheat protection (OHP)

If the internal temperature rises to an abnormal level, overheat protection will be activated and an alarm (ALM-02: P.U OHP) will be generated. Leave the PCR-WEA Series on, and wait for approximately 10 minutes.

If, after an OHP alarm is once cleared 10 minutes later, another OHP alarm no longer occurs, the product may be installed incorrectly or the dust filter may be clogged.

If an OHP alarm occurs again, stop using the product and contact your Kikusui agent or distributor to request repairs.

Advanced Functions

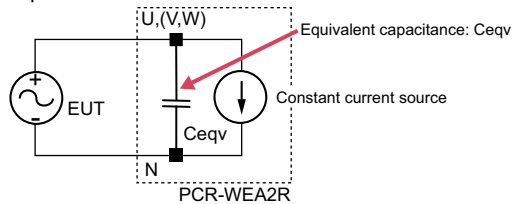
Displaying the equivalent capacitance

This function displays the capacitor capacity value of this unit at OUTPUT ON near 50/60 Hz as a reference.

This product has capacitive(capacitor) impedance characteristics when viewed from the EUT, which may cause a leading reactive current to flow or waveform oscillation. Keep this in mind for such cases.

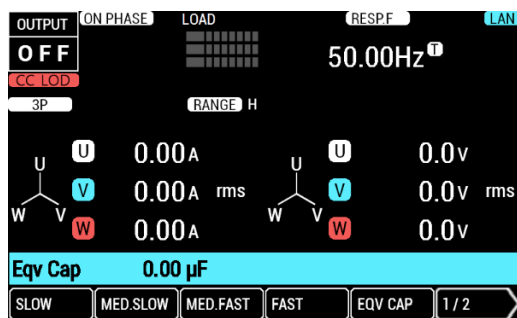
The value of the equivalent capacitance varies depending on the wiring, range, response setting, and the number of power modules(power capacity) in operation.

Equivalent circuit



1 Press OTHERS(SHIFT+MEMORY) > 1/2 (F6) > RESP (F3) > EQV CAP (F5).

The equivalent capacitance is displayed.



NOTE

If the CR function is enabled, the equivalent capacitance is displayed as "--. -- μF".

Using the reactive current suppression function

When AC voltage is applied, leading reactive current flows due to the equivalent capacitance. This function automatically cancels out the reactive current. It operates only when the input sync signal in the sync settings is set to "Terminal".

NOTE

Enabling this function improves the reproducibility of the current waveform, therefore its use is recommended.

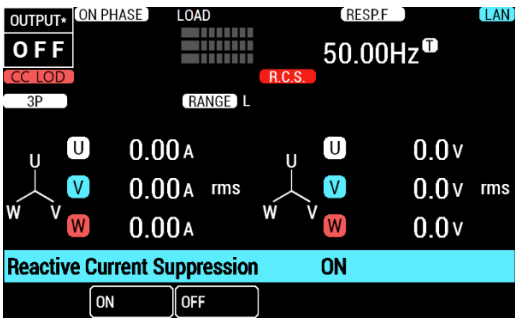
However, since this function operates in CC (constant current) mode, overvoltage may occur if the load input terminal is open or the EUT stops.

If you are using CR mode to prevent overvoltage, disabling this function is recommended.

Setup procedure

1 Press SYNC (SHIFT+9) > 1/2 (F6) > R.C.S. (F1).

2 Set the reactive current suppression function.

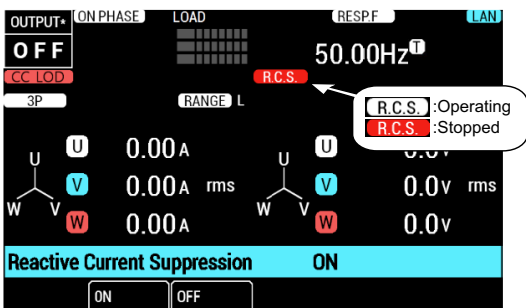


Item	Title	Description
ON (F2)	Reactive Current Suppression	Using the reactive current suppression function
OFF (F3)		Not using the reactive current suppression function (factory default setting).

This completes the setting.

Status of the reactive current suppression function

While the reactive current suppression function is active, the icon lights up white; while inactive, it lights up red.



Selecting the Response

Depending on the application and operational stability, you can set the response to one of the following four levels.

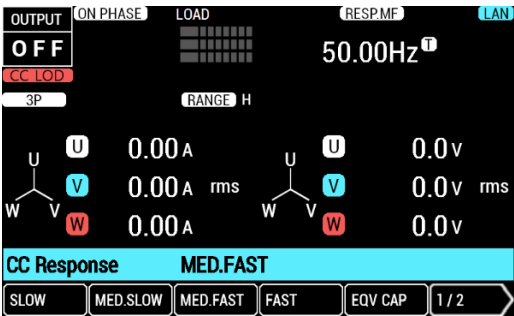
It cannot be changed while OUTPUT is on.

NOTE

If you want to suppress current waveform distortion or if reproducibility or high slew rate is required, set the response to Fast. However, depending on the circuit and wiring conditions of the load (especially inductive loads), operation may become unstable or oscillate. In such cases, setting a slower response can improve stability.

1 Press OTHERS (SHIFT+MEMORY) > 1/2 (F6) > RESP (F3).

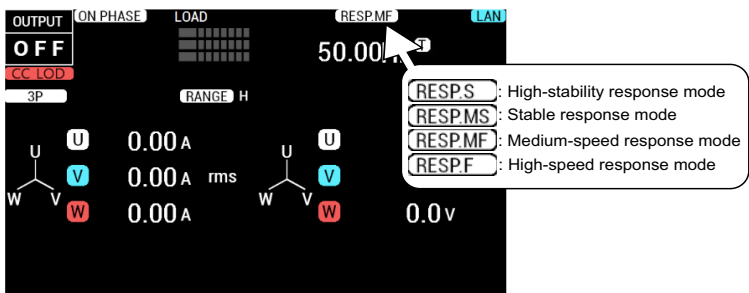
2 Select the response.



Item	Title	Description
SLOW (F1)	CC Response	High-stability response mode
MED.SLOW (F2)		Stable response mode
MED.FAST (F3)		Medium-speed response mode
FAST (F4)		High-speed response mode (factory default setting)

3 Press ENT.

The selected mode is displayed on the panel.



This completes the setting.

Setting the damping frequency

Set the damping frequency according to the oscillation of the current waveform. It cannot be changed while OUTPUT is on.

Depending on the circuit of the load (especially inductive loads), the current waveform may oscillate. This function attenuates (damps) the oscillation by matching the damping frequency to the oscillation frequency.

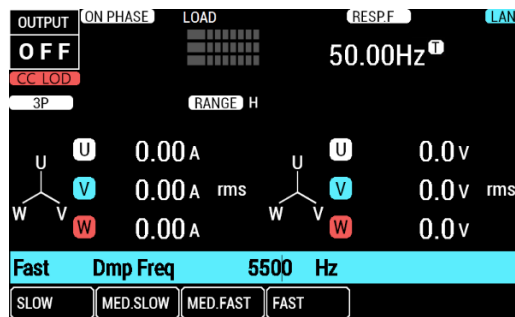
NOTE

If damping by this function is insufficient or the operation becomes unstable, set a lower damping frequency or slow down the response.

1 Press OTHERS (SHIFT+MEMORY) > 1/2 (F6) > RESP (F3) > 1/2 (F6) > DMP FREQ (F1).

2 Set the damping frequency.

The resolution is 1 Hz.



Item	Title	Setting range	Description
SLOW (F1)	Slow Dmp Freq	2000 Hz to 11800 Hz	Damping frequency for high-stability response mode (SLOW). Factory default is 5500 Hz.
MED.SLOW (F2)	Med Slow Dmp Freq	1100 Hz to 12500 Hz	Damping frequency for stable response mode (MED SLOW). Factory default is 6000 Hz.
MED.FAST (F3)	Med Fast Dmp Freq	600 Hz to 13600 Hz	Damping frequency for medium-speed response mode (MED FAST). Factory default is 6500 Hz.
FAST (F4)	Fast Dmp Freq	500 Hz to 15400 Hz	Damping frequency for high-speed response mode (FAST). Factory default is 7500 Hz.

3 Press ENT.

This completes the setting.

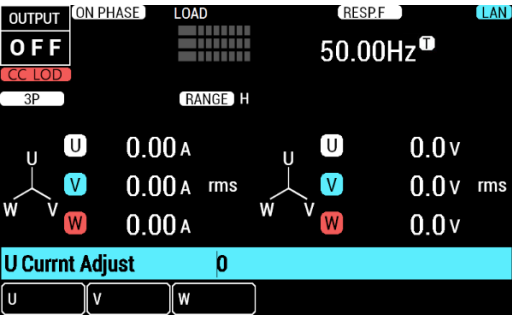
Setting the current offset

You can set the offset for the input current (DC). This is effective for fine adjustment to 0 A.
 For single-phase three-wire and three-phase connections, set a current offset for each phase.

1 Press **CONFIG (SHIFT+OPR MODE) > 1/3 (F6) > 2/3 (F6) > ADJUST (F2) > CURR ADJ (F1).**

2 Set the current offset.

The setting resolution is 10. The factory default setting is 0.



■ 1P

Item	Title	Setting range	Description
CURR ADJ (F1)	Current Adjust	-200 to 200	Current offset

■ 1P3W,3P

Item	Title	Setting range	Description
U (F1)	U Current Adjust	-200 to 200	U-phase current offset
V (F2)	V Current Adjust		V-phase current offset
W ¹ (F3)	W Current Adjust		W-phase current offset

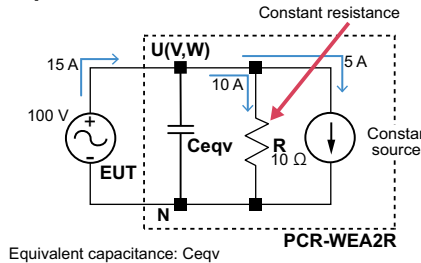
1. Only for the three-phase setting

Using the constant resistance (CR) function

The constant resistance (CR) function supplies current in proportion to changes in voltage.

This function operates in CC+CR mode, supplying current in both constant current and constant resistance modes. To use only CR operation, set the current setting value to 0 A.

Equivalent circuit



Example:

EUT: 100 V

CR resistance (R): 10 Ω

Mode: CC Load

Current setting: 5 A

Synchronization delay phase angle: 0 deg

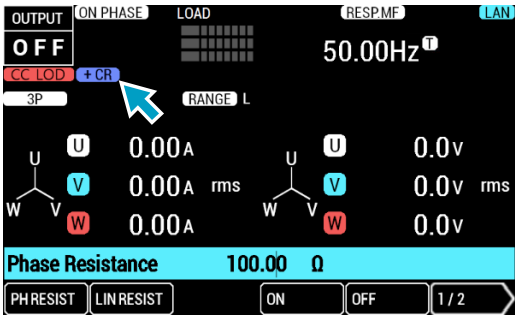
The figure shows the flow of current under the above conditions. A current of 10 A flows by CR operation with a resistance of 10 Ω , and a current of 5 A flows by CC operation with the current setting. A total current of 15 A is supplied from the EUT as a result.

Turning the CR function on and off

1 Switch the display screen using the following procedure:

Connection method	Setup procedure
1P	$I > 1/2$ (F6) > CR (F4)
1P3W	$I > 1/4$ (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4)
3P	

2 Turning the CR function on and off



Item	Title	Description
ON (F4)	--	Using the CR Functions When CR is enabled, the "+CR" icon appears on the display.
OFF (F5)		CR function is not used (factory default setting).

This completes the setting.

Setting the CR function resistance value

NOTE

- If there are power modules that are paused by the power module management function, the resistance setting range is changed according to the number of power modules (power capacity) that are running.
- When the power module management setting is changed, the resistance values are reset to factory default settings.
- The resolution of the CR resistance value has a range that differs between the resolution that can be entered and the resolution that can actually be set. For details, see “Relationship between the setting resolution and the internal resolution of CR resistance value setting” (p.229)

1 Set the CR resistance value using the following procedure:

The resolution is 0.01 Ω.

If the phases have different resistance settings, the unbalance icon will appear. (p.37)

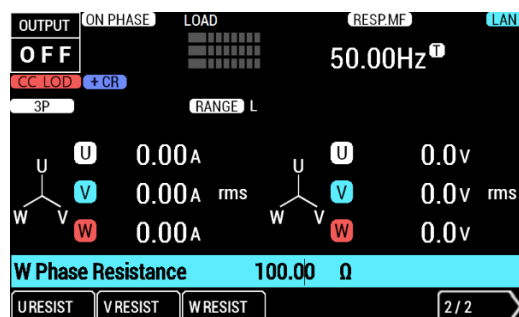
Connection method	Phase to set	Setup procedure
1P	--	$I > 1/2 (F6) > CR (F4) > RESIST (F1)$
1P3W	All phases	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > PH RESIST (F1)$
	U-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > U RESIST (F1)$
	V-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > V RESIST (F2)$
	Line-to-line resistance ¹	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > LIN RESIST (F2)$
3P	All phases	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > PH RESIST (F1)$
	U-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > U RESIST (F1)$
	V-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > V RESIST (F2)$
	W-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > W RESIST (F3)$
	Line-to-line resistance ²	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > LIN RESIST (F2)$

1. When the line-to-line resistance value is changed, the resistance value of all phases is changed to half the line-to-line resistance value.
2. When the line-to-line resistance value is changed, the resistance value of all phases is changed to one-third of the line-to-line resistance value.

The setting range varies depending on the model, wiring method, and selected range.

See “Setting range” in the “Output” (p.214) section of the “Specifications” part.

For the factory default settings, see “Factory default settings” (p.204)



2 Press ENT.

This completes the setting.

Using the Memory

NOTE

Pieces of memory data are saved for each operating mode.

Thus, the saved memory data cannot be recalled in an operation mode other than that in which the data were saved.

To recall the saved memory data, switch to the operation mode in which the data were saved.

For the procedure for saving to memory and the memory recall procedure, see “Using the Memory” in the User’s Manual.

Items that can be saved

■ Internal memory

The product has a preset memory and setup memory.

- Preset Memory

The following items can be saved to the internal preset memory (A, B, C).

- AC current setting value
- DC current setting value
- Frequency setting value
- waveform bank number

Memory contents can be easily recalled with a simple operation, which is useful when switching between three settings.

- Setup memory

Panel settings can be saved to the internal setup memory.

■ USB memory device

The following items can be saved to a USB memory device.

- Panel settings
- Sequence data
- Waveform bank data

Using the Compensation (Voltage compensation) Function

The compensation function compensates for voltage drops in the load cables when the DUT is connected to the product over a long distance. This product offers three types of sensing: hard sensing, soft sensing, and regulation adjust, but only hard sensing is available in CC Load mode.

■ Hard sensing

Connect the DUT to the SENSING terminal of this product. Hard sensing is effective when using the CR function to supply current considering voltage drop.

Hard sensing can compensate the voltage up to approximately 1.5 V for a single line.

Hard sensing wiring

WARNING

Risk of electric shock.

- Before you connect the load or sensing cables, turn the **POWER** switch off, and then turn off the switchboard.
 - Firmly attach the terminal box cover.
-

We recommend that you run the load wires alongside each other and tie them together at several points with cable ties. Connect the output and load terminals using the shortest possible wiring.

Hard sensing can compensate up to approximately 1.5 V for a single line. Select a load cable that has sufficient current capacity to prevent the voltage drop in the cable from exceeding the compensation voltage.

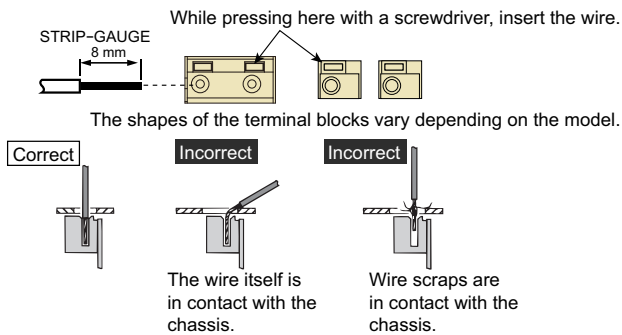
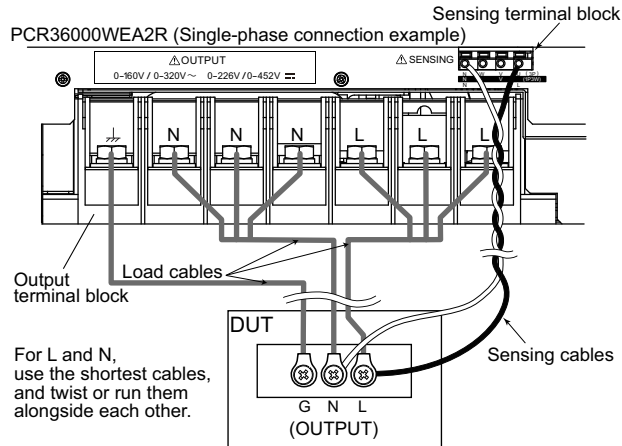
CAUTION

It may cause a malfunction in the product or the DUT.

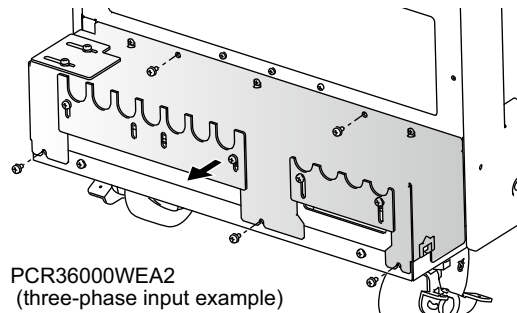
If the sensing cables become disconnected or the polarities are incorrect, an overvoltage will be generated. The protection function will be activated and the load will be turned off, but an overvoltage will be generated for the several hundreds of milliseconds before the protection function is activated.

Use AWG22 - AWG16 cables when connecting to the SENSING terminals. Strip approximately 8 mm of coating from the end of the cables.

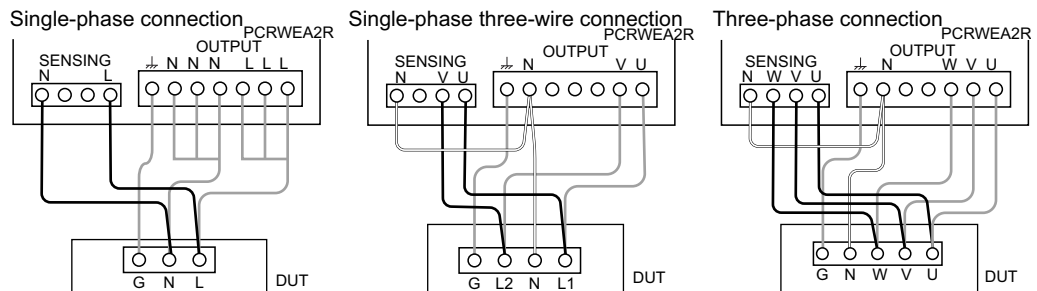
OUTPUT terminal block and SENSING terminal block



- 1 Turn the POWER switch off.
- 2 Turn off the DUT power switch.
- 3 Unfasten the five M4 screws from the terminal block cover, and remove the cover.

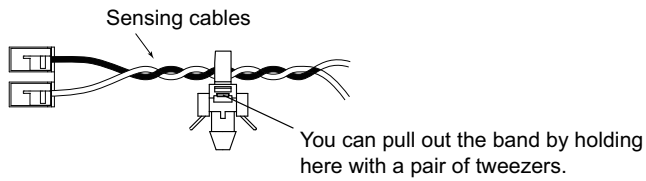


- 4 Connect the cables by referring to the following sensing wiring diagrams.

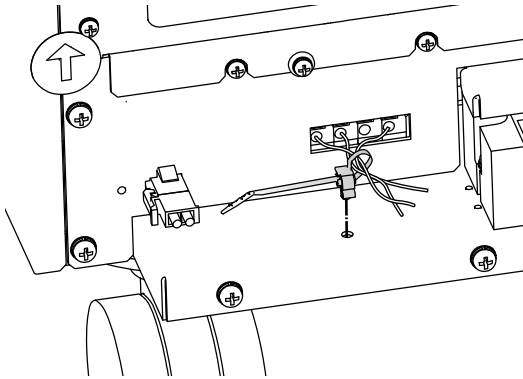


5 Use the included cable tie to gently tie the cables as shown below.

The cable tie can be reused. Do not cut the extraneous portion of the tie.

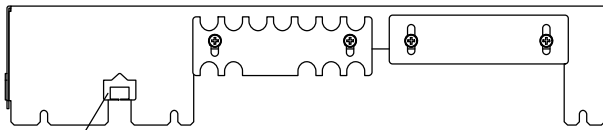


6 Attach the tip of the cable tie to the product as shown below.



7 Firmly tighten the cable tie so that the sensing cables do not come loose.

8 Attach the terminal covers.



For the PCR6000WEA2R/ PCR12000WEA2R, run the sensing cables through here.
PCR18000WEA2R/ PCR24000WEA2R/ PCR30000WEA2R/ PCR36000WEA2R, run the sensing cables through the gap in the OUTPUT terminal block.

Using the Harmonic Analysis Function

CC Load mode enables harmonic analysis of input voltage and input current.

If the sync function icon ([p.26](#)) is blinking or displays “NG”, measured values cannot be displayed.

For details, see “Using the Harmonic Analysis Function” in the User’s Manual.

Using special waveforms (waveform bank)

Peak clipped and flat curve waveforms are available.

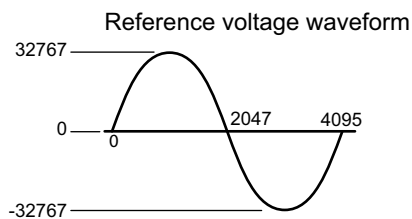
This product controls current and voltage to produce the selected special waveform and simulates actual load conditions.

You can use remote control to configure user-defined waveforms. For details, see the communication interface manual.

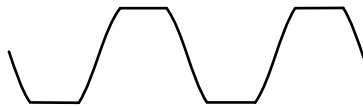
This product stores voltage waveform data in internal memory and creates a reference waveform of the input voltage by D/A conversion of that data.

One cycle (360° phase angle) consists of 12 bits horizontally and 16 bits vertically.

The reference voltage waveform of the PCR-WEA Series is a sine wave. A sine wave whose positive peak is 32767 and negative peak is -32767 is assigned.



Peak clipped waveforms, flat curve waveforms



If the peak is set within the ± 32767 range, it will be corrected internally by this product. To use more accurate waveforms, it is recommended to utilize the full ± 32767 peak range.

■ Waveform bank

The stored waveform data in memory that corresponds to one waveform is referred to as a waveform bank. This product has 257 waveform banks. You can number the banks from 0 to 256 and select the desired waveform by one of these numbers. The waveform banks are stored for each operation mode. Waveform bank 0 consists of calculated sine wave data with a phase setting resolution of 0.01° . This bank cannot be overwritten.

By factory default, sine waves are preset for all waveform banks.

■ Peak-clipped waveform

The peak portion of waveforms is clipped by the specified crest factor value. The sine waveform is adjusted so that the specified rms value and the rms value of the waveform that is actually input are the same.

The crest factor is the ratio of the AC waveform's peak value to its rms value.

Crest factor = peak value / rms value.

For a sine wave, the crest factor is 1.41. In the voltage waveforms of commercial power lines, the peaks are clipped, so the crest factor is between 1.2 and 1.4.

■ Flat curve waveform

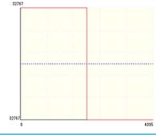
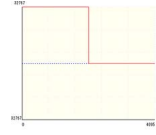
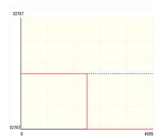
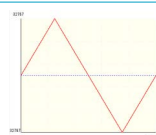
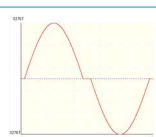
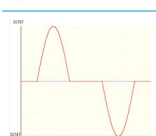
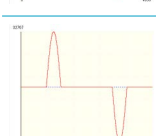
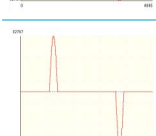
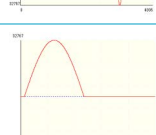
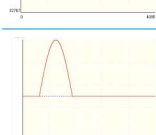
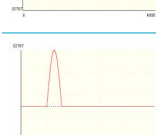
This is a waveform defined in IEC61000-4-13.

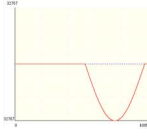
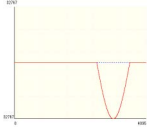
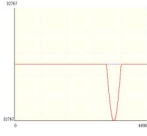
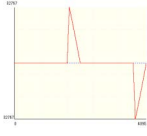
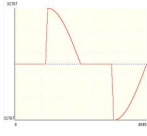
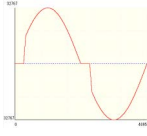
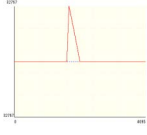
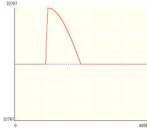
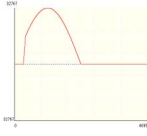
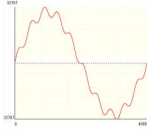
The peak of the waveform is clipped by the specified clip factor (the waveform peak is defined to be 1).

The specified rms value and the rms value of the waveform that is actually input are not the same.

Sample waveforms

Sample waveforms are preset in the waveform banks. To use a sample waveform, select its waveform bank number.

Waveform bank number	Waveform information	
236	Square wave	Full wave 
237		Upper half wave 
238		Lower half wave 
239	Triangular	Full wave 
240	Capacitor input CF=1.5	Full wave 
241	Capacitor input CF=2.0	
242	Capacitor input CF=3.0	
243	Capacitor input CF=4.0	
244	Capacitor input CF=1.5	Upper half wave 
245	Capacitor input CF=2.0	
246	Capacitor input CF=3.0	

Waveform bank number	Waveform information	
247	Capacitor input CF=1.5	Lower half wave 
248	Capacitor input CF=2.0	
249	Capacitor input CF=3.0	
250	Phase control 30 deg	Full wave 
251	Phase control 90 deg	
252	Phase control 150 deg	
253	Phase control 30 deg	Upper half wave 
254	Phase control 90 deg	
255	Phase control 150 deg	
256	Harmonics (10th, 10%)	Full wave 

Creating a waveform bank

Waveform banks cannot be created while using the external analog input function (EXTDC).

1 Press OTHERS (SHIFT+MEMORY) > WAVE (F2) > EDIT(F5).

2 Press EWB No. (F1) to select the waveform bank number to be created (1 to 235).

Waveform bank numbers 236 to 256 cannot be edited because they contain preset sample waveforms.

3 Select the waveform.

If you select the peak clipped waveform, also set the crest factor.

If you select the flat curve waveform, also set the clip factor.

Item	Title	Description
SIN (F3)	Edit WB No.	Selects the sine wave
P.C (F4)		Sets the crest factor of the peak-clipped waveform (1.10 to 1.40).
FLT.C (F5)		Sets the clip factor (0.4 to 1.0) of the flat curve waveform.

4 Press APPLY(F4).

This completes the setting. To cancel, press CANCEL(F5).

Setting special waveforms

NOTE

The power may be supplied in the opposite direction (from the product to the EUT) depending on special waveforms (waveform bank) to be used. To prevent the operation of the EUT from being affected, check the setting details of a waveform in advance.

You cannot change the waveform bank number while a soft start is being performed, a soft stop is being performed, or when the product is being controlled by an external analog signal and the signal source is set to external signal (EXT) only.

■ Single-phase, single-phase three-wire, two-phase, three-phase (setting all phases collectively)

1 Press OTHERS (SHIFT+MEMORY) > WAVE (F2) to select the waveform bank number.

“S.WAVE” is displayed in the following cases.

Single-phase or single-phase three-wire connection: The waveform bank number must be other than 0.

Two-phase connection: The waveform bank number must be other than 0 for all U- and V-phases.

Three-phase connection: The waveform bank number must be other than 0 for all U-, V-, and W-phases.

Item	Title	Description
WB No. (F1)	WB No.	Specifies the waveform bank number to be used (0 to 256).

2 Press APPLY (F4).

To cancel, press CANCEL(F5).

This completes the setting.

■ Setting each phase individually for two- and three-phase configurations

1 Press OTHERS (SHIFT+MEMORY) > WAVE (F2) > 1/2 (F6) to select the waveform bank number for each phase.

“S.WAVE” is displayed in the following cases.

Two-phase connection: The waveform bank number must be other than 0 for all U- and V-phases.

Three-phase connection: The waveform bank number must be other than 0 for all U-, V-, and W-phases.

Item	Title	Description
U WB No. (F1)	U WB No.	Specifies the waveform bank number to use for the U-phase (0 to 256).
V WB No. (F2)	V WB No.	Specifies the waveform bank number to use for the V-phase (0 to 256).
W WB No. (F3)	W WB No.	Specifies the waveform bank number to use for the W-phase (0 to 256).

2 Press APPLY(F4).

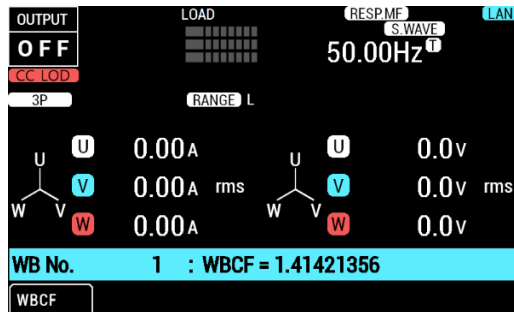
To cancel, press CANCEL(F5).

This completes the setting.

Displaying the crest factor of a special waveform

1 Press OTHERS (SHIFT+MEMORY) > WAVE (F2) > WBCF(F4).

2 Select the waveform bank for which to display the crest factor.



Stop using a special waveform (revert to sine wave)

To stop using a special waveform, set the waveform bank number to 0.

Configuring Soft Start and Soft Stop

CC Load mode enables the use of soft start/ soft stop settings for the current and CR resistance values. When OUTPUT is turned on (load on)/off (load off), the following operations occur.

■ soft start

- Current: The current value gradually increases from 0 A.
- CR resistance: The resistance value gradually decreases from $\infty \Omega$.

■ Soft stop

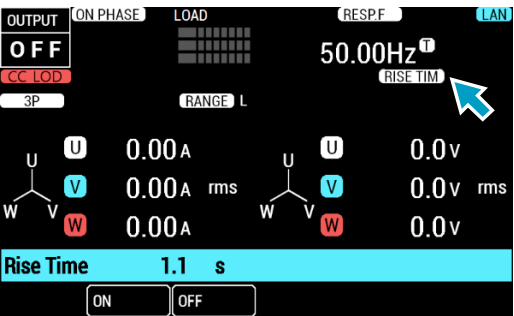
- Current: The current value gradually decreases to 0 A.
- CR resistance: The resistance value gradually increases to $\infty \Omega$.

When you set soft start to on, "RISE TIM" will be displayed.
 When you set soft stop to on, "FALL TIM" will be displayed.
 While the soft stop is in operation, "OFF" of OUTPUT OFF blinks.
 The OUTPUT key is invalid when soft stop is being performed.

Configuring soft start

1 Press OTHERS (SHIFT+MEMORY) > RISE TIM (F1) to configure soft start.

If you select ON, "RISE TIM" will be displayed.

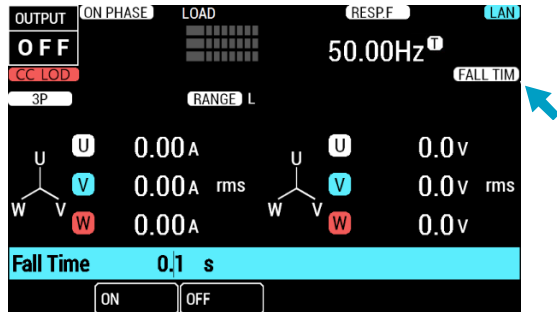


Item	Title	Description
ON (F2)	Rise Time	Sets the rise time (0.1 s to 30.0 s). Enables soft start
OFF (F3)		The soft start function is turned off.

This completes the setting.

Configuring soft stop

- 1 Press OTHERS (SHIFT+MEMORY) > 1/ 2 (F6) > FALL TIM (F1) to configure soft stop.
If you select ON, "FALL TIM" will be displayed.



Item	Title	Description
ON (F2)	Fall Time	Sets the fall time (0.1 s to 3.0 s). Enables soft stop
OFF (F3)		Soft stop off

This completes the setting.

Using the Power Management Functions

The PCR-WEA Series has the following two power management functions: a sleep function and a power-saving function

For details, see "Using the Power Management Functions" in the User's Manual.

NOTE

- If the following functions are turned on in the CC+CR mode, the CR mode will be automatically canceled.
 - Power-saving function (Power Save)
 - Power module management function
- If the sync function is turned on, the sleep function will not be activated.

CC SUPPLY Mode

This chapter explains how to use the CC Supply mode.

Installation and Preparation

Connecting the Power Cord

See “Connecting the Power Cord” in the User’s Manual.

Turning the Power On

See “Turning the Power On” in the User’s Manual.

Connecting the Load

See “Connecting the Load” in the User’s Manual.

Basic Functions

Panel Operation Basics

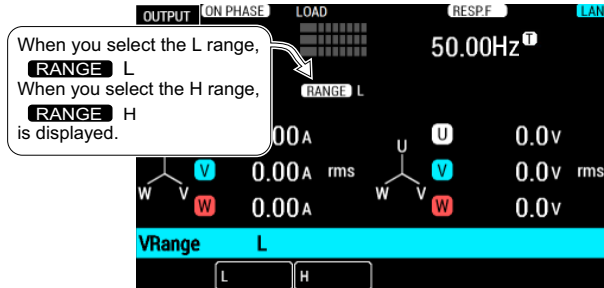
See “Panel Operation Basics” in the User’s Manual.

Selecting the Output Method

See “Selecting the Output Method” in the User’s manual.

Setting the output current

Setting the voltage/current range



- 1 Press RANGE (SHIFT+8).
- 2 Select the range you want to set.

Since the range is based on voltage, the range of settable current is wider in the L range and narrower in the H range.

Item	Title	Description
L (F2)	VRange	Set to L range (factory default setting)
H (F3)		Set to H range

Current setting range					
Power capacity	Range	AC current (Arms)		DC current (A)	
		1P	1P3W/3P	1P	1P3W/3P
6 kVA	L range	0.00 to 66.00	0.00 to 22.00	-66.00 to 66.00	-22.00 to 22.00
	H range	0.00 to 33.00	0.00 to 11.00	-33.00 to 33.00	-11.00 to 11.00
12 kVA	L range	0.00 to 132.00	0.00 to 44.00	-132.00 to 132.00	-44.00 to 44.00
	H range	0.00 to 66.00	0.00 to 22.00	-66.00 to 66.00	-22.00 to 22.00
18 kVA	L range	0.00 to 198.00	0.00 to 66.00	-198.00 to 198.00	-66.00 to 66.00
	H range	0.00 to 99.00	0.00 to 33.00	-99.00 to 99.00	-33.00 to 33.00
24 kVA	L range	0.00 to 264.00	0.00 to 88.00	-264.00 to 264.00	-88.00 to 88.00
	H range	0.00 to 132.00	0.00 to 44.00	-132.00 to 132.00	-44.00 to 44.00
30 kVA	L range	0.00 to 330.00	0.00 to 110.00	-330.00 to 330.00	-110.00 to 110.00
	H range	0.00 to 165.00	0.00 to 55.00	-165.00 to 165.00	-55.00 to 55.00
36 kVA	L range	0.00 to 396.00	0.00 to 132.00	-396.00 to 396.00	-132.00 to 132.00
	H range	0.00 to 198.00	0.00 to 66.00	-198.00 to 198.00	-66.00 to 66.00

Reference: Voltage ranges		
Range	AC voltage	DC voltage
L range	0.0 V to 161.0 V	-227.5 V to +227.5 V
H range	0.0 V to 322.0 V	-455.0 V to +455.0 V

NOTE

- If there are power modules that are paused by the power module management function, the current setting range of the range is changed according to the number of power modules (power capacity) that are running.
- If you change the power module management settings, the range will change to the factory default setting (L range).

3 Press ENT.

After switching the range, the system will be in a busy state for approximately 0.6 seconds.
The range setting is complete.

Setting the current value

NOTE

For AC + DC output, a current with a waveform where AC is superimposed on DC (or vice versa) is output.

In this case, the total of configurable AC and DC current values is limited.

Set them to meet the following conditions:

$$(\text{AC current setting}) \times \sqrt{2} + |\text{DC current setting}| \leq (\text{rated current}) \times 110 \% \times \sqrt{2}$$

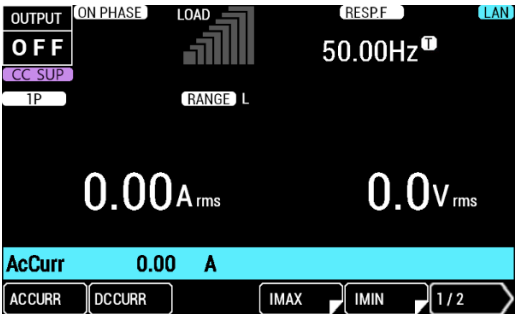
Rated currents vary depending on models (power capacity), wiring methods (single-phase / single-phase three-wire / three-phase), and L/H ranges. For details, see Specifications (p.214).

■ **Single-phase two-wire (1P2W)**

1 Set the current value using the procedure below.

AC/DC	Setup procedure
AC	I > AC CURR (F1)
DC	I > DC CURR (F2)

The current setting range varies depending on the model and the selected range.
See “Setting range” in the “Output” (p.214) section of the “Specifications” part.



■ Single-phase three-wire (1P3W)

1 Set the current value using the procedure below.

If the phases have different current settings, the unbalance icon will appear. (p.86)

AC/DC	Phase to set	Setup procedure
AC	All phases	$I > \text{AC PH CURR (F1)}$
	U-phase	$I > 1/4 \text{ (F6)} > \text{U AC CURR (F1)}$
	V-phase	$I > 1/4 \text{ (F6)} > \text{V AC CURR (F2)}$
DC	All phases	$I > \text{DC PH CURR (F2)}$
	U-phase	$I > 1/4 \text{ (F6)} > 2/4 \text{ (F6)} > \text{U DC CURR (F1)}$
	V-phase	$I > 1/4 \text{ (F6)} > 2/4 \text{ (F6)} > \text{V DC CURR (F2)}$

The current setting range varies depending on the model and the selected range.

See “Setting range” in the “Output” (p.214) section of the “Specifications” part.



Example when all phases are selected in AC

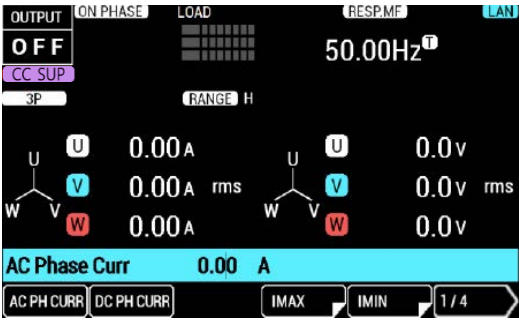
■ Three-phase (3P)

1 Set the current value using the procedure below.

If the phases have different current settings, the unbalance icon will appear. (p.86)

AC/DC	Phase to set	Setup procedure
AC	All phases	$I > \text{AC PH CURR (F1)}$
	U-phase	$I > 1/4 \text{ (F6)} > \text{U AC CURR (F1)}$
	V-phase	$I > 1/4 \text{ (F6)} > \text{V AC CURR (F2)}$
	W-phase	$I > 1/4 \text{ (F6)} > \text{W AC CURR (F3)}$
DC	All phases	$I > \text{DC PH CURR (F2)}$
	U-phase	$I > 1/4 \text{ (F6)} > 2/4 \text{ (F6)} > \text{U DC CURR (F1)}$
	V-phase	$I > 1/4 \text{ (F6)} > 2/4 \text{ (F6)} > \text{V DC CURR (F2)}$
	W-phase	$I > 1/4 \text{ (F6)} > 2/4 \text{ (F6)} > \text{W DC CURR (F3)}$

The current setting range varies depending on the model and the selected range.
See "Setting range" in the "Output" (p.214) section of the "Specifications" part.



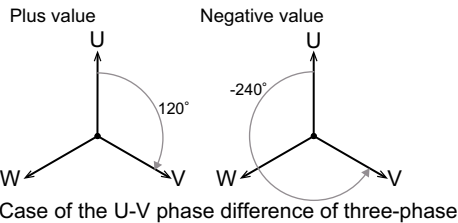
Example when all phases are selected in AC

Setting the current phase difference

The current phase difference is set.

The setting can be designated in either plus or minus phase.

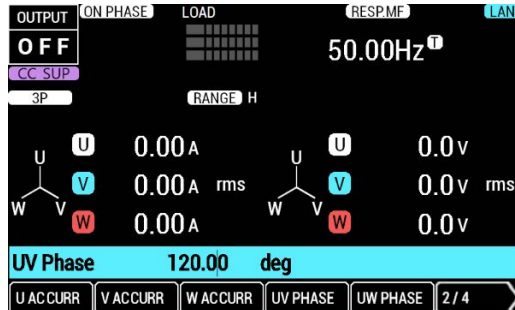
If the U-V phase difference is set to $+120^\circ$ or -240° , for example, those are the same difference (120°) and the product operates in the same way for both cases as a result.



■ U-V phase difference

1 Press I > 1/4 (F6) > UV PHASE (F4) to set the phase difference.

If an unbalanced phase difference is set, the unbalance icon will appear. (p.86)

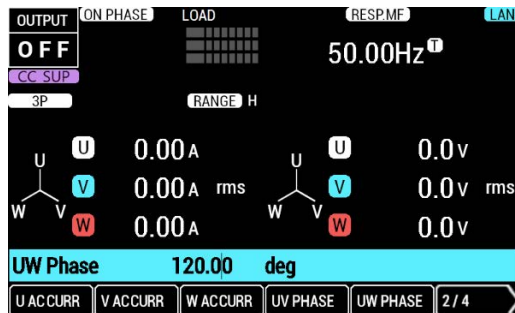


Item	Title	Description
UV PHASE (F4)	UV Phase	Setting the U-V phase difference (-360 to 360 deg). Factory default: • 180.00 deg (1P3W) • 120.00 deg (3P)

■ U-W phase difference

1 Press I > 1/4 (F6) > UW PHASE (F5) to set the phase difference.

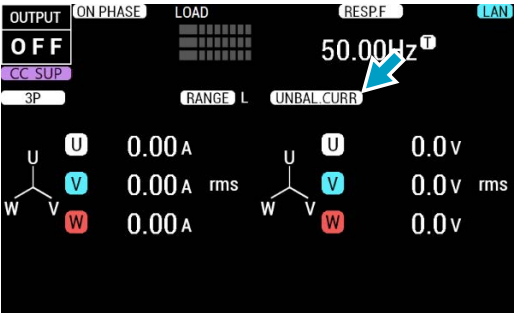
If an unbalanced phase difference is set, the unbalance icon will appear. (p.86)



Item	Title	Description
UW PHASE (F5)	UW Phase	Setting the U-W phase difference (-360 to 360 deg). Factory default: • 270.00 deg (3P)

Specifying unbalance

If you set each phase to different currents or resistance values, or set the phase difference to unbalanced, the unbalance icon appears.



Output	phase difference		Current of each phase	Resistance of each phase	Display
	U-V	U-W			
Output	Other than 180°	--	Same	Same	UNBAL.PHAS
	180°	--	Different	Same	UNBAL.CURR
	180°	--	Same	Different	UNBAL.RES
	Other than 180°	--	Different	Same	UNBAL.PHAS,CURR
	180°	--	Different	Different	UNBAL.CURR,RES
	Other than 180°	--	Same	Different	UNBAL.PHAS,RES
	Other than 180°	--	Different	Different	UNBAL.PHAS,CURR,RES
3P	Other than 120° ¹	Other than 240° ¹	Same	Same	UNBAL.PHAS
	120°	Other than 240° ¹	Different	Same	UNBAL.CURR
	120°	240°	Same	Different	UNBAL.RES
	Other than 120° ¹	Other than 240° ¹	Different	Same	UNBAL.PHAS,CURR
	120°	240°	Different	Different	UNBAL.CURR,RES
	Other than 120° ¹	Other than 240° ¹	Same	Different	UNBAL.PHAS,RES
	Other than 120° ¹	Other than 240° ¹	Different	Different	UNBAL.PHAS,CURR,RES

1. If either the “U and V” or “U and W” condition applies, the configuration is considered unbalanced.

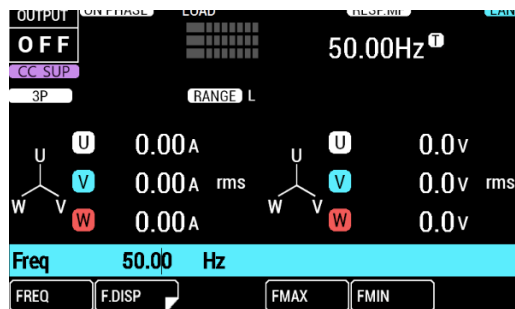
Setting the frequency

Set the frequency limit to prevent the product from generating a frequency that is greater than is necessary. (p. 100)

On the 500 Hz limit model, the upper limit is limited to 500 Hz only for three-phase output.

Setup procedure

1 Press F > FREQ (F1) to set the frequency.



Item	Title	Description	Conditions that are not allowed
FREQ (F1)	Freq	Sets the frequency (1.00 Hz to 5000 Hz). Factory default: 50.00 Hz	Sync function on The external analog signal source is EXT. The frequency is being changed with an external analog signal. The frequency is outside the range defined by the frequency limits.

Turning output on/off

⚠ WARNING

Risk of electric shock.

- Do not touch the OUTPUT terminal block or the sensing terminals.
- If a capacitor, battery, or similar item is connected as the load, a voltage remains until the load's energy is discharged, even when the output is off. Do not touch parts that are connected to the OUTPUT terminal block or sensing terminals.

⚠ CAUTION

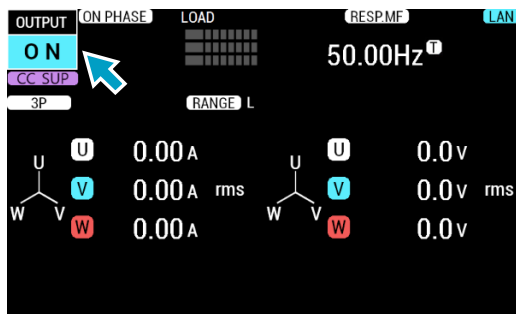
Depending on the current and load inductance, an undershoot or overshoot ranging from several hundred millivolts to several volts may be produced when the output is turned on or off.

Each time that you press OUTPUT, the output toggles between on and off.

■ Output on

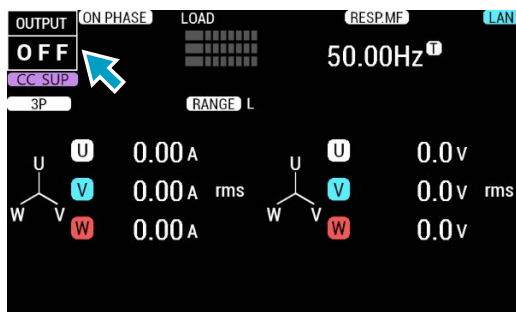
“OUTPUT ON” is shown on the display.

The output is produced with the specified current and frequency.



■ Output off

“OUTPUT OFF” is shown on the display.



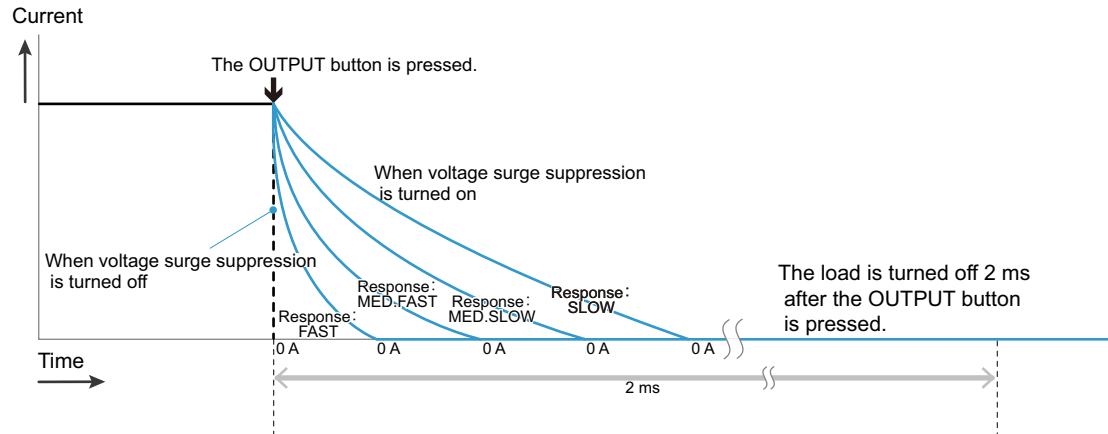
Voltage surge suppression when the output is turned off

If an unbalanced phase difference is set, the unbalance icon will appear.

If voltage surge suppression is turned on, a current is controlled to 0 A when OUTPUT is turned off and this state is kept for about 2 ms after the OUTPUT button is pressed.

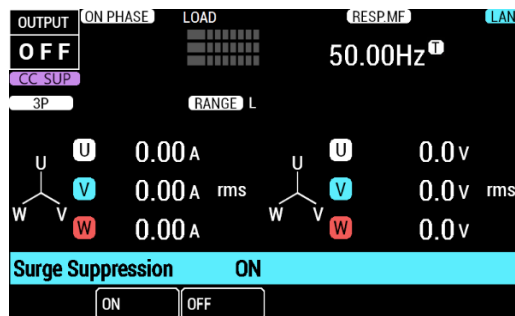
A voltage surge immediately after output is turned off can be suppressed in this way.

Note that a fall time until a current drops to 0 A varies depending on the response setting.



If the voltage surge suppression function is off, "OUTPUT*" is displayed.

- 1 Press CONFIG (SHIFT+OPR MODE)> 1/3 (F6)> SURGE S (F2) to set voltage surge suppression.

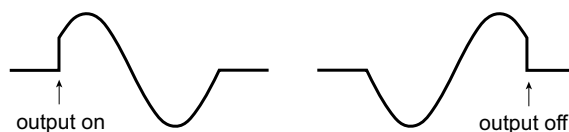


Item	Title	Description
ON (F2)	Surge suppression	Voltage surge suppression on
OFF (F3)		Voltage surge suppression off

Output on/off phase control

You can set the output-on phase and output-off phase separately for AC output.

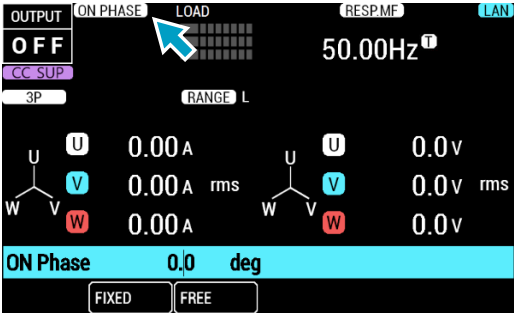
For single-phase three-wire output and three-phase output, set the U-phase.



■ Output on phase setup procedure

When you are controlling the output-on phase, set the phase angle as well.
If the output-on phase is set, "ON PHASE" is displayed.
See notes for inrush current (p.8) to set it.

1 Press ON PHASE (SHIFT+7) to set the output-on phase.

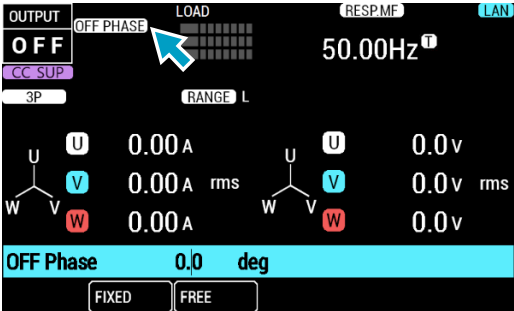


Item	Title	Description
FIXED (F2)	ON Phase	Enables output-on phase control (factory default setting) Sets the output-on phase angle (0.0 deg to 360.0 deg). 0.0 deg = 360.0 deg
FREE (F3)		The output-on phase is not controlled.

■ Output off phase setup procedure

When you are controlling the output-off phase, set the phase angle as well.
If the output-off phase is set, "OFF PHASE" is displayed.

1 Press OFF PHASE (SHIFT+4) to set the output-off phase.



Item	Title	Description
FIXED (F2)	OFF Phase	Enables output-off phase control Sets the output-off phase angle (0.0 deg to 360.0 deg). 0.0 deg = 360.0 deg
FREE (F3)		The output-off phase is not controlled.

AC coupling

This product inputs the internally generated AC signal (AC REF) directly into the DC amplifier. Therefore, the DC component included in the AC REF signal is also amplified and output.

This function is effective when amplifying the voltage of an external analog input and outputting only the AC current.

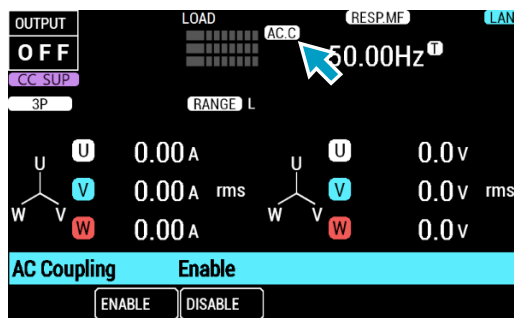
When a voltage containing a DC component that should not be reflected in the output is applied to the external analog input, enabling this function allows AC coupling.

Because the amplifier is AC coupled, the output voltage is reduced slightly in the low frequency range.

The frequency response is within $\pm 1\%$ in the 40 Hz to 999.9 Hz range with 200 Hz as the reference.

When AC coupling is enabled, "AC.C" is displayed.

1 Press OPR MODE > ACC.COUP (F1) to set AC coupling.



Item	Title	Description
ENABLE (F2)	AC Coupling	Enables AC coupling
DISABLE (F3)		Disables AC coupling (factory default)

Measurement display

You can monitor the present output value. When the output is off, this is nearly 0.

You can change the phase to display for single-phase three-wire output and three-phase output.

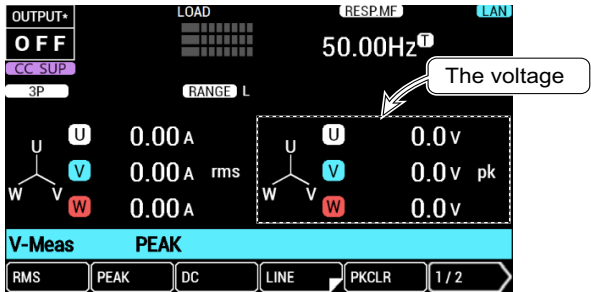
Displaying the voltage

The measured voltage is displayed in the status, measured-value, and setting display area.

You can select whether to display the rms, peak, or average voltage.

■ Switching display items

- 1 Press the V-MEAS(SHIFT+V) key to switch the voltage display.



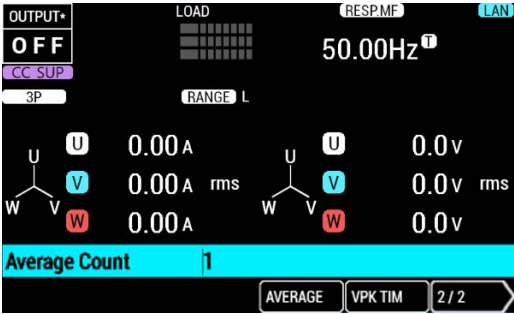
Item	Title	Unit	Description
RMS (F1)	V-Meas	V rms	Displays the rms voltage
PEAK (F2)		V pk	Displays the peak voltage
DC (F3)		V dc	Displays the average voltage
LINE ¹ (F4)	ON (F2)	V rms	Displays the line voltage
	OFF (F3)		Displays the phase voltage

1. Only for single-phase three-wire and three-phase settings

■ Averaging voltage measurements

You can average the rms-voltage and average-voltage measurements and display the result.

- 1 Press V-MEAS (SHIFT+V) > 1/2 (F6) > AVERAGE (F4) to set voltage value averaging.

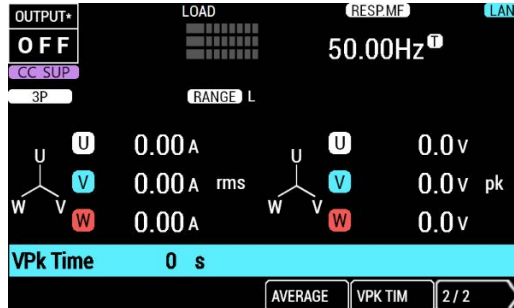


Item	Title	Description
AVERAGE (F4)	Average Count	Values will be averaged. Average count (moving average): 1 to 32

■ Holding the peak voltage

If the measurement display is set to peak voltage, the peak voltage can be held.

- 1 Press V-MEAS (SHIFT+V) > 1/2 (F6) > VPK TIM (F5) to set the hold time.



Item	Title	Description
VPK TIM (F5)	VPk Time	Sets the hold time (0 s to 10 s or ∞). If you use the numeric key pad to specify a value that is greater than or equal to 11, infinity (∞) will be specified.

■ Clearing the peak voltage

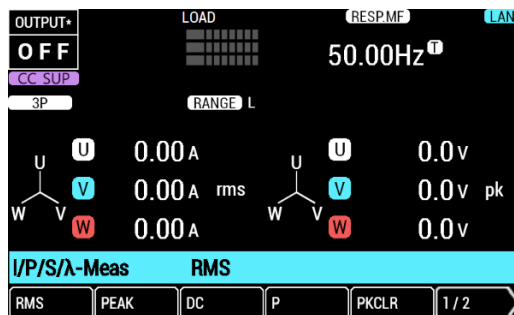
- 1 Press V-MEAS (SHIFT+V) > PKCLR (F5) to clear the peak voltage.

Displaying the current, power, and power factor

You can select which value to display normally in the status, measured-value, and setting display area from rms current, peak current, average current, power, apparent power, and power factor.

■ Switching display items

- 1 Press the I/P/S/λ-MEAS (SHIFT+I) key to switch the display.



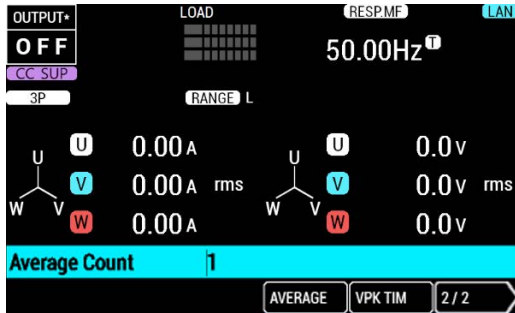
Item	Title	Unit	Description
RMS (F1)	I/P/S/λ-Meas	A rms	Displays the rms current
PEAK (F2)		A pk	Displays the peak current
DC (F3)		A dc	Displays the average current
P (F4)		W/ kW	Displays the power
1/2 (F6) > S (F1)		VA/ kVA	Displays the apparent power
1/2 (F6) > λ (F2)		λ	Displays the power factor
1/2 (F6) > TOTAL ¹ (F3)		W/ kW	Displays the total power

1. Only for single-phase three-wire and three-phase settings

■ Averaging current and power measurements

You can display the averaged measurements of rms currents, average currents, power values, apparent power values, and power factors.

- 1 Press I/P/S/λ-MEAS (SHIFT+I) > 1/2 (F6) > AVERAGE (F4) to set current value averaging, power value, and power factor value averaging.

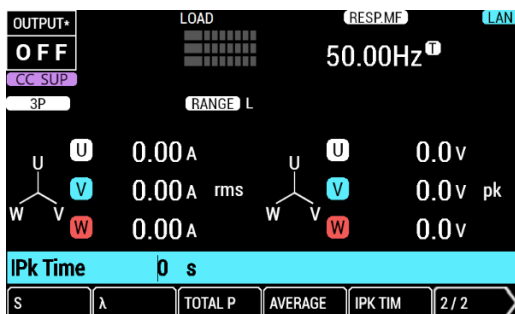


Item	Title	Description
AVERAGE (F4)	Average Count	Values will be averaged. Average count (moving average): 1 to 32

■ Holding the peak current

The peak current is displayed as an absolute value of the maximum instantaneous current measured. Even if a negative DC voltage is being generated, the peak current is displayed as a positive value. If the measurement display is set to peak current, the peak current can be held.

- 1 Press I/P/S/λ-MEAS (SHIFT+I) > 1/2 (F6) > IPK TIM (F5) to set the hold time.



Item	Title	Description
IPK TIM (F5)	IPk Time	Sets the hold time (0 s to 10 s or ∞). If you use the numeric key pad to specify a value that is greater than or equal to 11, infinity (∞) will be specified.

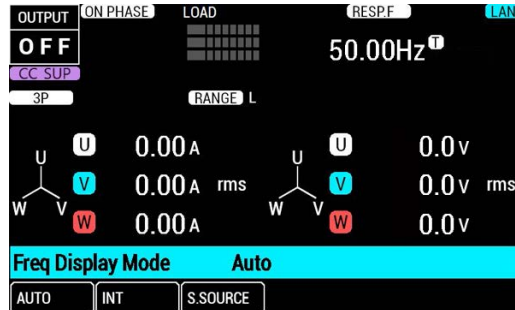
■ Clearing the peak current

- 1 Press I/P/S/λ-MEAS (SHIFT+I) > PKCLR (F5) to clear the peak current.

Frequency display

Select the type of frequency to display.

1 Press F > F.DISP (F2) to switch the type of frequency displayed.



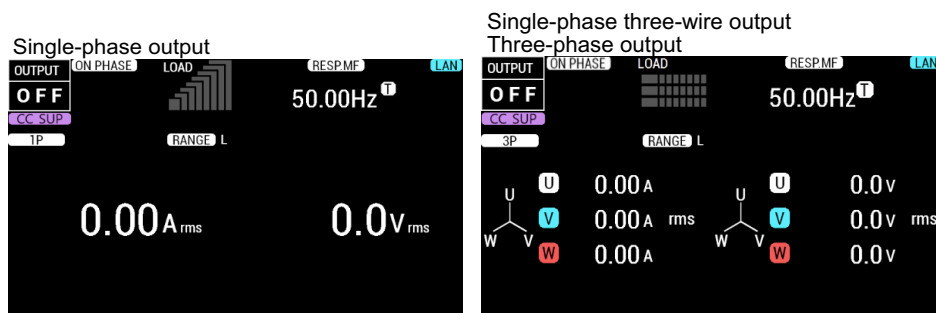
Item	Title	Sync function	Input sync signal	Description	Displayed icon
AUTO (F1)	Freq Display Mode	OFF	LINE/EXT/TERM	Input frequency setting	
		ON	LINE	Measured frequency value (LINE input)	
			EXT	Measured frequency value (EXT input)	
			TERM	Measured frequency value (TERM input)	
INT (F2)		ON/ OFF	LINE/EXT/TERM	Input frequency setting	
S.SOURCE (F3)		ON/ OFF	LINE	Measured frequency value (LINE input)	
			EXT	Measured frequency value (EXT input)	
			TERM	Measured frequency value (TERM input)	

LOAD level meter

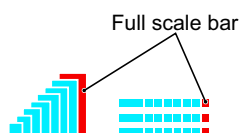
The LOAD level meter displays the ratio of the output current (which is detected as the current flowing through the load) to the rated current in a bar graph. This can be used to determine the approximate output current supply capability. The full scale of the LOAD level meter is 1.1 times the rated current or the output overcurrent protection (OCP) setting, whichever is less.

When using a single-phase three-wire connection, phases U and V are displayed from the top.

When using a three-phase connection, phases U, V, and W are displayed from the top.



The full scale bar (the right-most bar that lights red) of the LOAD level meter lights on the verge of an overload.



When the PCR-WEA is on the verge of an overload, the internal temperature increases. Even if the load is reduced, the full scale bar may continue to light dimly in red. When cooling is complete, the full scale bar turns off.

If an overload occurs repeatedly while the full-scale bar is lit, an alarm (ALM-06: OVERLOAD) may be triggered.

Rated current and LOAD level meter display

The output current varies depending on the load. The rated current is automatically derated(reduced) depending on the output conditions (output voltage and frequency).

For how to calculate the rated current value, see “Output and Load” in the User’s Manual.

The full scale of the LOAD level meter is set to 1.1 times the calculated rated current or the current limit, whichever is less.

Limit Functions and Protection Functions

This product has the following limit functions and protection functions.

- Limit functions

Limits can be placed on this product's output current setting and frequency setting to prevent damage to the load caused by mistaken operations and limit the current that flows through the load. You can set limits according to the load conditions.

- Protection Functions

The protection function applies limits when there is a danger of damaging the product's internal circuitry and to protect the load.

When a protection function is activated, an alarm (ALM-xx) or a trouble indication (TRBL-xx) is generated, and the output is turned off.

Parameter	Function	Description	Output off
Upper current limit Lower current limit	Limit	After you set the current limits, you can no longer specify current values outside the limit range.	No
Upper frequency limit Lower frequency limit	Limit	After you set the frequency limits, you can no longer specify frequency values outside the limit range.	No
Upper resistance limit Lower resistance limit	Limit	After you set the resistance limits, you can no longer specify CR resistance values outside the limit range.	No
Upper limit of synchronization delay phase angle Lower limit of synchronization delay phase angle	Limit	After you set the limit values of synchronization delay phase angle, you can no longer specify synchronization delay phase angle values outside the limit range.	No
Upper limit of synchronization delay phase angle offset Lower limit of synchronization delay phase angle offset	Limit	After you set the limit values of synchronization delay phase angle offset, you can no longer specify synchronization delay phase angle values outside the limit range.	No
Output overcurrent protection (OCP)	Protection	Any current exceeding the upper limit turns output off. You cannot set the lower limit.	Yes
Output overvoltage protection (OVP)	Protection	If the measured voltage exceeds the OVP value, an alarm occurs, and the output turns off.	Yes
Output undervoltage protection (UVP)	Protection	If the measured voltage falls below the UVP value, an alarm occurs, and the output turns off.	Yes
Input voltage drop protection (AC INPUT LOW)	Protection	If an input voltage of the AC power line drops below the rated value, a trouble indication occurs and output is turned off.	Yes
Overload protection (OVERLOAD)	Protection	If the output current exceeds the rated current or current limit, an alarm occurs, and the output turns off.	Yes
Overheat protection (OHP)	Protection	If the internal temperature increases abnormally, an alarm occurs, and the output turns off.	Yes

Setting Limits

Upper and lower current limits

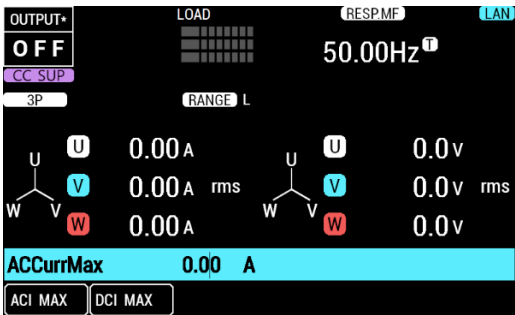
After you set the current limits, you can no longer specify current values outside the limit range.
 Set the limits so that the lower limit is less than or equal to the upper limit.
 There are AC limits and DC limits. Check the title in the entry area, and then set the value.

NOTE

- If there are power modules that are paused by the power module management function, the limit setting range is changed according to the number of power modules (power capacity) that are running.
- When the power module management setting is changed, the limit values are reset to factory default settings.

■ Setting the upper limit value

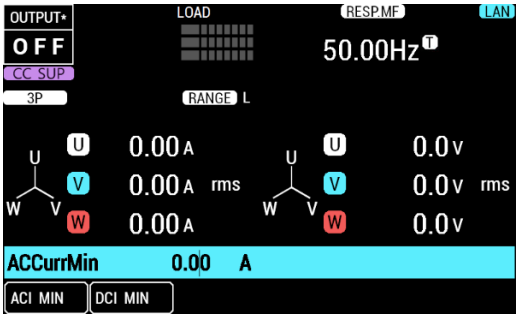
1 Press I > IMAX (F4) to set the upper limit value.



Item	Title	Description
ACI MAX (F1)	ACCurrMax	Sets the upper limit value of AC current (0 A to maximum current setting value). Factory default: 110% of rated current
DCI MAX (F2)	DCCurrMax	Sets the upper limit value of DC current (minimum to maximum current setting value). Factory default: 110% of rated current

■ Setting the lower limit values

1 Press I > IMIN (F5) to set the lower limit value.



Item	Title	Description
ACI MIN (F1)	ACCurrMin	Sets the lower limit value of AC current (0 A to maximum current setting value). Factory default setting: 0 A
DCI MIN (F2)	DCCurrMin	Sets the lower limit value of DC current (minimum to maximum current setting value). Factory default: 110% of negative rated current

Upper and lower frequency limits

After you set the frequency limits, you will no longer be able to specify frequency values that are outside of the range that you have set.

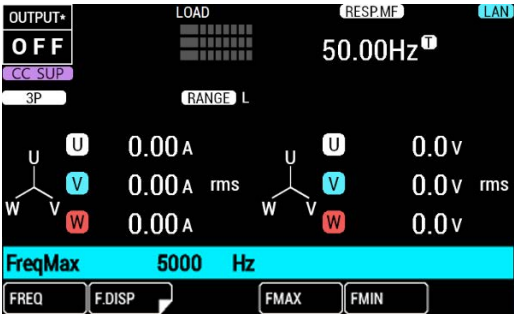
Set the limits so that the lower limit is less than or equal to the upper limit.

Limits apply to all phases for single-phase three-wire output and three-phase output.

On the 500 Hz limit model, only for three-phase output, the upper frequency limit is set to 500.0 Hz.

■ Setting the upper limit value

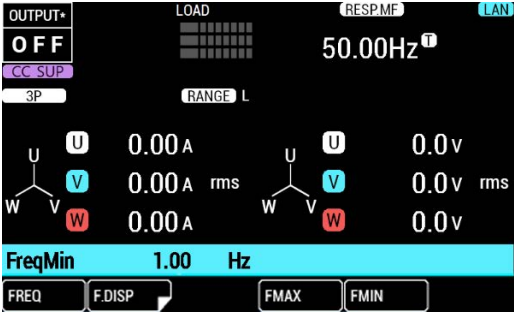
1 Press F > FMAX (F4) to set the upper limit value.



Item	Title	Description
FMAX (F4)	FreqMax	Sets the upper frequency limit(1.00 Hz to 5000 Hz). Factory default: 65.00 Hz

■ Setting the lower limit values

1 Press F > FMIN(F5) to set the lower limit value.



Item	Title	Description
FMIN (F5)	FreqMin	Sets the lower frequency limit(1.00 Hz to 5000 Hz). Factory default: 45.00 Hz

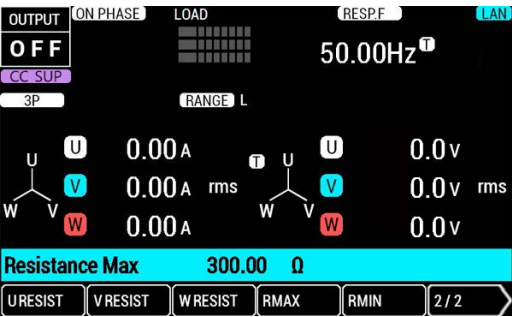
Upper and lower resistance limits

After you set the resistance limits, you can no longer specify CR resistance values outside the limit range.
Set the limits so that the lower limit is less than or equal to the upper limit.

■ Setting the upper limit value

1 Set the upper limit value using the following procedure:

Connection method	Setup procedure
Single-phase	$I > 1/2 (F6) > CR (F4) > 1/2 (F6) > RMAX (F4)$
Single-phase three-wire	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > RMAX (F4)$
Three-phase	



Item	Title	Description
RMAX (F4)	Resistance Max	Sets the upper limit value of the CR resistance.

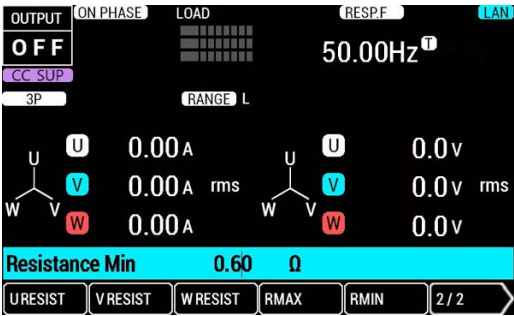
The setting range and factory default settings vary depending on the model, wiring method, and selected range.

- Setting Range: See the “Output” (p.214) section of the “Specifications” part.
- Factory default settings: See “Panel settings” (p.206)

■ Setting the lower limit values

1 Set the lower limit value using the following procedure:

Connection method	Setup procedure
1P	$I > 1/2 (F6) > CR (F4) > 1/2 (F6) > RMIN (F5)$
1P3W	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > RMIN (F5)$
3P	



Item	Title	Description
RMIN (F5)	Resistance Min	Sets the lower limit value of CR resistance.

The setting range and factory default settings vary depending on the model, wiring method, and selected range.

- Setting Range: See the “Output” (p.214) section of the “Specifications” part.
- Factory default settings: See “Panel settings” (p.206)

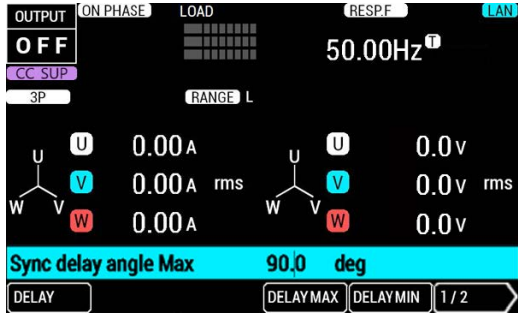
Upper and lower limits of synchronization delay phase angle

After you set the limit values of synchronization delay phase angle, you can no longer specify synchronization delay phase angle values outside the limit range.

Set the limits so that the lower limit is less than or equal to the upper limit.

■ Setting the upper limit value

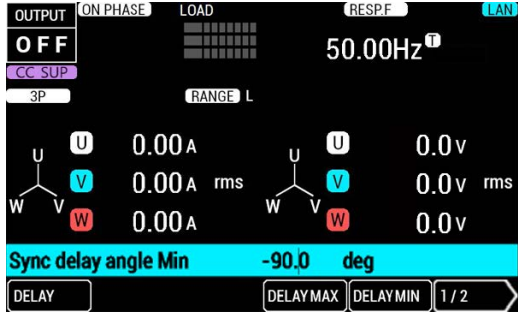
- 1 Press SYNC (SHIFT+9) > DELAY (F4) > DELAY MAX (F4) to set the upper limit value.



Item	Title	Description
DELAY MAX (F4)	Sync delay angle Max	Sets the upper limit value of the synchronization delay phase angle (-360.0 to 360.0 deg). Factory default: 90.0 deg.

■ Setting the lower limit values

- 1 Press SYNC (SHIFT+9) > DELAY (F4) > DELAY MIN (F5) to set the lower limit value.



Item	Title	Description
DELAY MIN (F5)	Sync delay angle Min	Sets the lower limit value of the synchronization delay phase angle (-360.0 to 360.0 deg). Factory default: -90.0 deg.

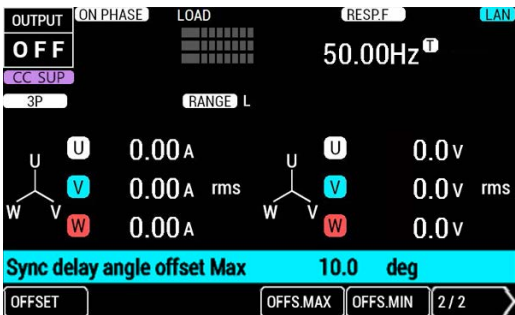
Upper and lower limits of synchronization delay phase angle offset

After you set the limit values of the synchronization delay phase angle offset, you can no longer specify synchronization delay phase angle offset values outside the limit range.

Set the limits so that the lower limit is less than or equal to the upper limit.

Setting the upper limit value

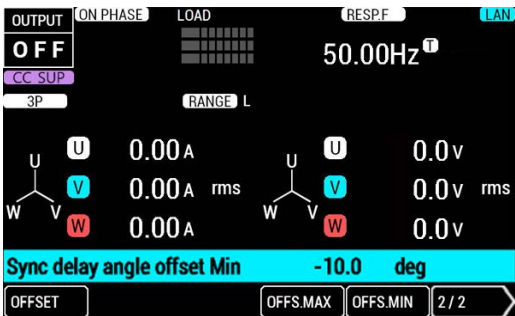
- 1 Press SYNC (SHIFT+9) > DELAY(F4) > 1/2 (F6) > OFFS MAX (F4) to set the upper limit value.



Item	Title	Description
OFFS MAX (F4)	Sync delay angle offset Max	Sets the upper limit value of the synchronization delay phase angle offset (-360.0 to 360.0 deg). Factory default: 10.0 deg.

Setting the lower limit values

- 1 Press SYNC (SHIFT+9) > DELAY (F4) > 1/2 (F6) > OFFS MIN (F5) to set the lower limit value.



Item	Title	Description
OFFS MIN (F5)	Sync delay angle offset Min	Sets the lower limit value of the synchronization delay phase angle offset (-360.0 to 360.0 deg). Factory default: -10.0 deg.

Protection Functions

Clearing alarms

Press ALM CLR (SHIFT+CLR) to clear the alarm, and then fix the problem that caused the alarm.

If an alarm still occurs even after you have corrected all the causes of alarms, the product may be malfunctioning.

Stop using it immediately, and contact your Kikusui agent or distributor.

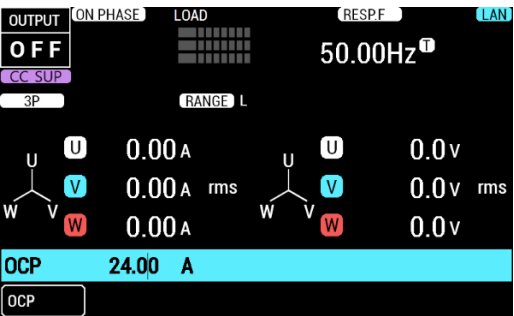
Output overcurrent protection (OCP)

If an output current exceeds the OCP setting (rms) continuously for approximately 100 to 200 ms, OCP will be activated.

An alarm (ALM-06: OVERLOAD) will be generated.

1 Set the OCP value using the following procedure:

Connection method	Setup procedure
1P	$I > 1/2 (F6) > \text{PROTECT (F3)} > \text{OCP (F1)}$
1P3W	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > \text{PROTECT (F3)} > \text{OCP (F1)}$
3P	



Item	Title	Description
OCP (F1)	OCP	Sets the OCP value (10% to 120% of rated current of L range). The factory default setting: 120% of rated current of L range.

⚠ CAUTION

Risk of malfunction.

If an overload occurs, be sure to remove the cause of the problem, and then press OUTPUT.

Output overvoltage protection (OVP)

If an output voltage exceeds the OVP setting (rms) continuously for approximately 100 to 200 ms, OVP will be activated.

If the peak output voltage exceeds the peak OVP setting continuously for the set trip time (configurable between 20 to 5020 μ s), in addition, OVP will be activated.

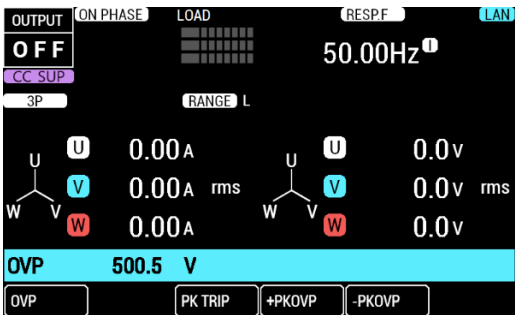
An alarm (ALM-00: OVP) will be generated.

NOTE

For internal protection, if the applied voltage exceeds the L range: ± 270 Vpk or the H range: ± 540 Vpk, overvoltage protection (OVP) will be activated regardless of the set OVP value and the trouble (TRBL-40-XX: OOS OVP) will appear.

■ OVP setting

1 Press **V > PROTECT (F3) > OVP (F1)** to set the OVP value.

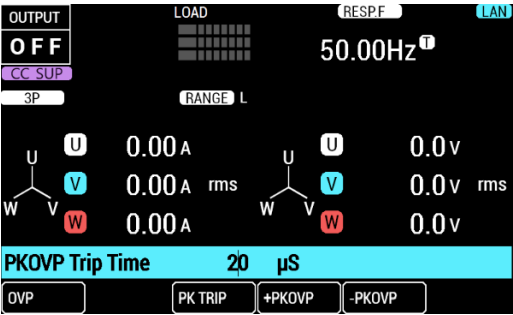


Item	Title	Description
OVP (F1)	OVP	Sets the OVP Value (14.0 to 500.5 V rms).
+PKOVP (F4)	+PKOVP	Sets the positive peak OVP value (14.0 V to 500.5 V).
-PKOVP (F5)	-PKOVP	Sets the negative peak OVP value (-500.5 V to -14.0 V).

■ Setting the peak OVP value (trip time)

You can set the time until the output turns off when it goes outside the range between the positive and negative peak OVP values.

- 1 Press **V > PROTECT (F3) > OVP(F1) > PK TRIP (F3)** to set the trip time for the peak OVP value.



Item	Title	Description
PK TRIP	PKOVP Trip Time	Sets the time (20 μs to 5020 μs) from when the peak OVP value is exceeded until the output is turned off. (The resolution is 100 μs)

Output undervoltage protection (UVP)

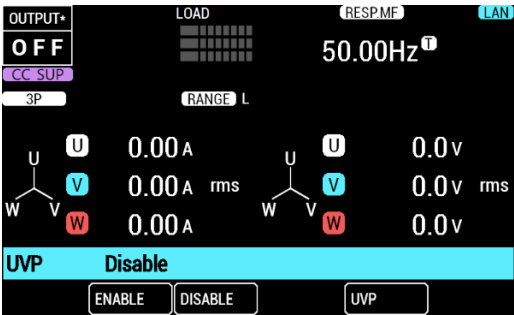
If an output voltage drops below the UVP setting continuously for approximately 100 to 200 ms, UVP will be activated.

An alarm (ALM-07: UVP) will be generated.

You can enable or disable UVP detection.

■ UVPsetting

1 Press **V > PROTECT (F3) > UVP (F2)** to set the UVP.



Item	Title	Description
ENABLE (F2)	UVP	Enables UVP.
DISABLE (F3)		Disables UVP. This is the default setting.
UVP (F5)		Sets the UVP Value (0.0 to 500.5 V rms).

Input voltage drop protection (AC INPUT LOW)

If the AC power line input voltage drops below the rated value, input voltage drop protection will be activated. Adjust the input voltage so that it is within the range in the specifications. If the input power supply wiring is long, use wires that have a large diameter to make the voltage drops smaller.

If the input voltage drops below the rating but recovers within 3 seconds, an alarm (ALM-29: AC INPUT LOW) will be generated.

If the input voltage continuously drops below the rated value, a trouble indication (TRBL-29: AC INPUT LOW) will be generated.

Turn off the POWER switch, and eliminate the cause of the alarm. If the trouble indication is generated again when you turn on the POWER switch, stop using the product immediately, and contact your Kikusui agent or distributor to request repairs.

Overload protection (OVERLOAD)

If the output current exceeds the rated current or the current limit value, the overload protection will be activated and an alarm (ALM-06: OVERLOAD) will be generated.

Press ALM CLR (SHIFT+CLR) to clear the alarm, and then fix the problem that caused the alarm.

Press the OUTPUT key again to resume output.

Overheat protection (OHP)

If the internal temperature rises to an abnormal level, overheat protection will be activated and an alarm (ALM-02: P.U OHP) will be generated. Leave the PCR-WEA Series on, and wait for approximately 10 minutes.

If, after an OHP alarm is once cleared 10 minutes later, another OHP alarm no longer occurs, the product may be installed incorrectly or the dust filter may be clogged.

If an OHP alarm occurs again, stop using the product and contact your Kikusui agent or distributor to request repairs.

Advanced Functions

Sync settings

The sync function synchronizes the frequency and phase of an output current of the product with the frequency and phase of a designated sync signal [input power supply voltage, output terminal voltage*, or external synchronization signal (EXT SYNCHRO)].

*: If hard sensing is connected, those are synchronized with hard sensing.

When controlling with an external analog signal and the signal source is set to external only (EXT), and if the frequency is changed by a DC signal from an external source, the sync function is disabled.

To finely control the synchronization phase of the input voltage on three-phase input, set the synchronization delay phase angle.

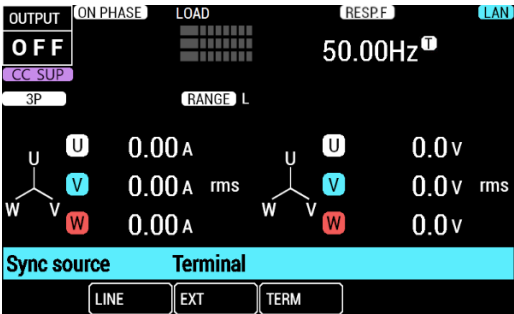
If a frequency lower than the frequency lower limit or higher than the frequency upper limit is input while synchronized, an alarm (ALM-20: SYNC ERR) will occur.

Selecting the input sync signal

You can select the signal to synchronize with.

To synchronize with an external sync input signal (reference phase input), you need to set selectable I/ O to SYNC CLK IN.

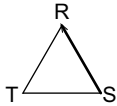
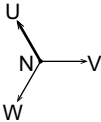
- 1 Press SYNC (SHIFT+9) > SOURCE (F5) to select the input sync signal.



Item	Title	Description
LINE (F2)	Sync source	Line Synchronizes with the input power supply
EXT (F3)		External Synchronizes with an external sync input signal
TERM (F4)		Terminal Synchronizes with the output terminal voltage

■ Phase

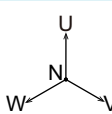
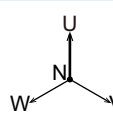
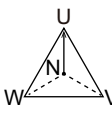
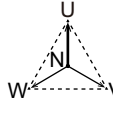
- Line

Input wiring	Phase to synchronize	
	1P 1P3W	3P
	3P3W 200 V input 	In-phase with input V_{R-S}  V_{U-N} and V_{R-S} are in phase.

- External

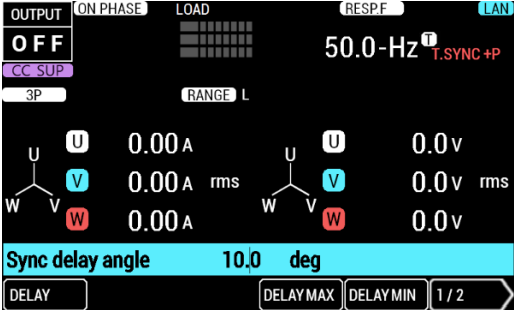
Synchronizes with a signal input to DIGITAL I/O.

- Terminal

Wiring method	Phase to synchronize			
	1P 1P3W		3P	
	1P input		In-phase with the input	—
	1P3W input		In-phase with input V_{U-N}	—
	3P4W input	—		 In-phase with the input
	3P3W input	—		 In-phase with the input

Setting the synchronization delay phase angle

- 1** Press SYNC (SHIFT+9) > DELAY (F4) to set the synchronization delay phase angle.
The resolution is 0.1 deg.

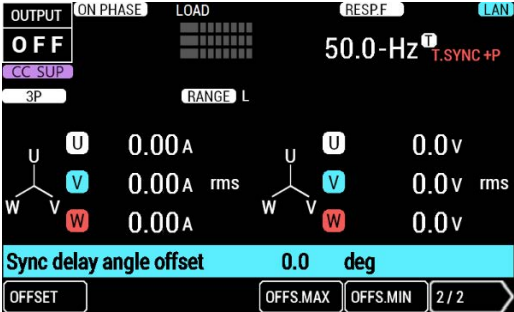


Item	Title	Description
DELAY (F4)	Sync delay angle	Sets the synchronization delay phase angle (-360.0 deg to 360.0 deg).

Setting the synchronization delay phase angle offset

To fine-tune the synchronization delay phase angle, set the synchronization delay phase angle offset.

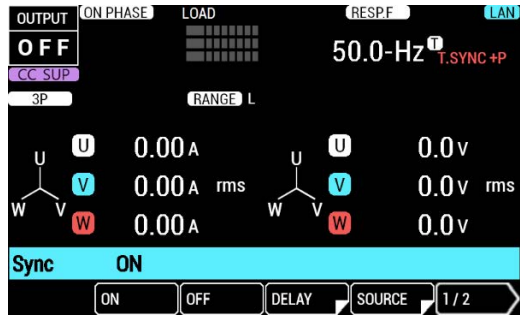
- 1** Press SYNC (SHIFT+9) > DELAY (F4) > 1/2 (F6) > OFFSET (F1) to set the synchronization delay phase angle offset.
The resolution is 0.1 deg.



Item	Title	Description
OFFSET (F1)	Sync delay angle offset	Sets the synchronization delay phase angle offset (-360.0 to 360.0 deg).

Turning the sync function on and off

1 Press SYNC (SHIFT+9) to turn the sync function on and off.



Item	Title	Description
ON (F2)	Sync	Using the Sync Function - If TERM is selected as the input sync signal T.SYNC¹ blinks until synchronization is established. When the frequency and the phase are synchronized after a few seconds, T.SYNC lights, and the synchronized frequency is displayed. - When the input sync signal is set to EXT EXT SYNC¹ blinks until synchronized. When the frequency and the phase are synchronized after a few seconds, EXT SYNC lights, and the synchronized frequency is displayed.
OFF (F3)		Not using the sync function(factory default setting).

1. If the synchronization delay phase angle is set, +P (positive delay phase angle) or -P (negative delay phase angle) will also be displayed.

NOTE

- When the sync function is turned on and synchronized, the last digit of the frequency display is hidden. This is because the frequency value slightly fluctuates due to synchronization. For example, "50.00 Hz" is displayed as "50.0-Hz", and "1000 Hz" is displayed as "100-Hz".
- In the following cases, synchronization will not be possible, and SYNC NG, T.SYNC NG, or EXT SYNC NG appears.
 - The voltage is below the detectable level.
 - The frequency of the applied voltage is outside the range of $F_{MIN} \leq x \leq F_{MAX}$.
 - The distortion or noise of the input voltage is extremely high.

The frequency that is used when the sync function is cleared

If the frequency when the sync function is in use is within the frequency limit range, it is set to the synchronized frequency.

For example, if the applied voltage frequency is synchronized at 50 Hz, the main unit's panel will display "50.0-Hz". If the sync function is released when the instantaneous synchronization frequency inside is "50.02 Hz", "50.00 Hz" will be set as the final synchronized frequency, rounded to the last digit.

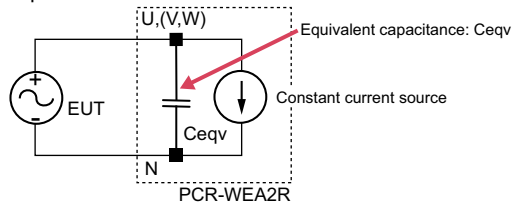
Displaying the equivalent capacitance

This function displays the capacitor capacity value of this unit at OUTPUT ON near 50/60 Hz as a reference.

This product has capacitive (capacitor) impedance characteristics when viewed from the EUT, which may cause a leading reactive current to flow or waveform oscillation. Keep this in mind for such cases.

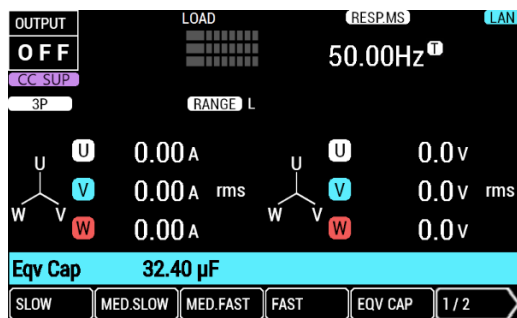
The value of the equivalent capacitance varies depending on the wiring, range, response setting, and the number of power modules (power capacity) in operation.

Equivalent circuit



1 Press OTHERS(SHIFT+MEMORY) > 1/2 (F6) > RESP (F3) > EQV CAP (F5).

The equivalent capacitance is displayed.



NOTE

If the CR function is enabled, the equivalent capacitance is displayed as "--. μF".

Using the reactive current suppression function

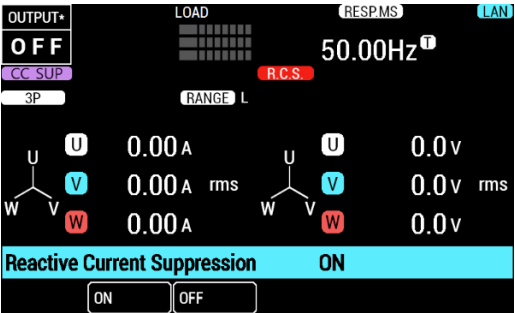
If the EUT serves as a voltage source, a leading reactive current will flow due to an equivalent capacitance (p. 114) when an AC voltage is applied between the output terminals of the product. This function automatically cancels out the reactive current. It operates only when the input sync signal in the sync settings is set to "Terminal".

NOTE

Enabling this function improves the reproducibility of the current waveform, therefore its use is recommended. However, since this function operates in CC (constant current) mode, overvoltage may occur if the load input terminal is open or the EUT stops. If you are using CR mode to prevent overvoltage, disabling this function is recommended.

Setup procedure

- 1 Press SYNC (SHIFT+9) > 1/2 (F6) > R.C.S. (F1).
- 2 Set the reactive current suppression function.

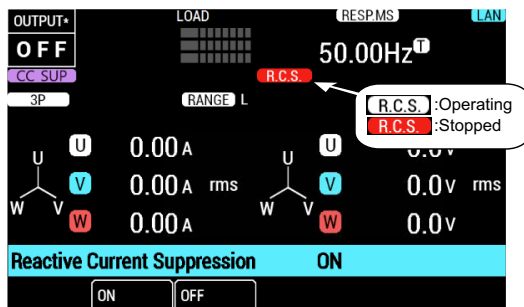


Item	Title	Description
ON (F2)	Reactive Current	Using the reactive current suppression function
OFF (F3)	Suppression	Not using the reactive current suppression function (factory default setting).

This completes the setting.

Status of the reactive current suppression function

While the reactive current suppression function is active, the icon lights up white; while inactive, it lights up red.



Selecting the Response

Depending on the application and operational stability, you can set the response to one of the following four levels.

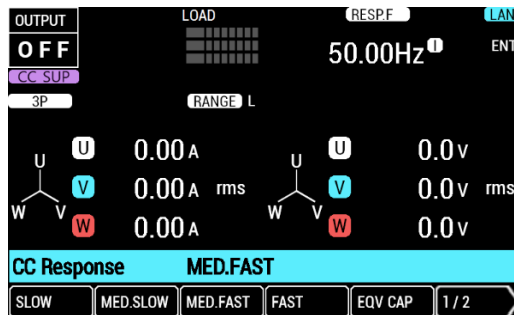
It cannot be changed while OUTPUT is on.

NOTE

If you want to suppress current waveform distortion or if reproducibility or high slew rate is required, set the response to Fast. However, depending on the circuit and wiring conditions of the load (especially inductive loads), operation may become unstable or oscillate. In such cases, setting a slower response can improve stability.

1 Press OTHERS (SHIFT+MEMORY) > 1/2 (F6) > RESP (F3).

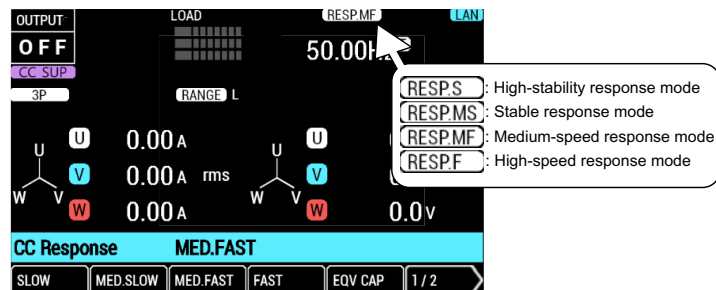
2 Select the response.



Item	Title	Description
SLOW (F1)	CC Response	High-stability response mode
MED.SLOW (F2)		Stable response mode
MED.FAST (F3)		Medium-speed response mode
FAST (F4)		High-speed response mode (factory default setting)

3 Press ENT.

The selected mode is displayed on the panel.



This completes the setting.

Setting the damping frequency

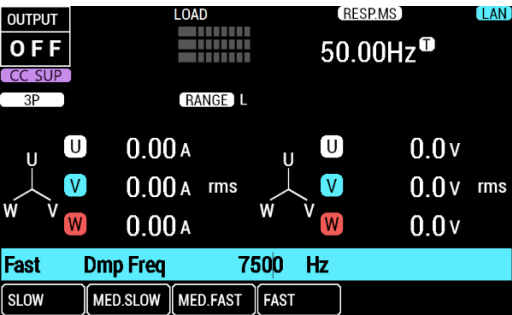
Set the damping frequency according to the oscillation of the current waveform. It cannot be changed while OUTPUT is on.
 Depending on the circuit of the load (especially inductive loads), the current waveform may oscillate. This function attenuates (damps) the oscillation by matching the damping frequency to the oscillation frequency.

NOTE

If damping by this function is insufficient or the operation becomes unstable, set a lower damping frequency or slow down the response.

- 1 Press OTHERS (SHIFT+MEMORY) > 1/2 (F6) > RESP (F3) > 1/2 (F6) > DMP FREQ (F1).
- 2 Set the damping frequency.

The resolution is 1 Hz.



Item	Title	Setting range	Description
SLOW (F1)	Slow Dmp Freq	2000 Hz to 11800 Hz	Damping frequency for high-stability response mode (SLOW). Factory default is 5500 Hz.
MED.SLOW (F2)	Med Slow Dmp Freq	1100 Hz to 12500 Hz	Damping frequency for stable response mode (MED SLOW). Factory default is 6000 Hz.
MED.FAST (F3)	Med Fast Dmp Freq	600 Hz to 13600 Hz	Damping frequency for medium-speed response mode (MED FAST). Factory default is 6500 Hz.
FAST (F4)	Fast Dmp Freq	500 Hz to 15400 Hz	Damping frequency for high-speed response mode (FAST). Factory default is 7500 Hz.

- 3 Press ENT.
This completes the setting.

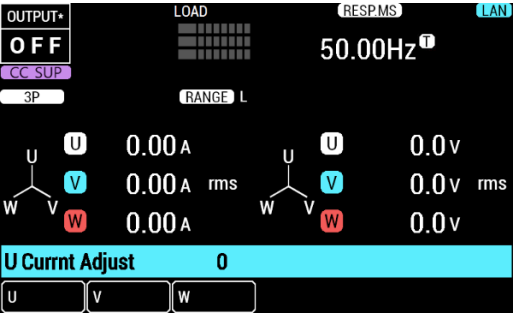
Setting the current offset

You can set the offset of output DC current. This is effective for fine adjustment to 0 A.
 For single-phase three-wire and three-phase connections, set a current offset for each phase.

1 Press CONFIG(SHIFT+OPR MODE) > 1/3 (F6) > 2/3 (F6) > ADJUST (F2) > CURR ADJ (F1).

2 Set the current offset.

The setting resolution is 10. The factory default setting is 0.



1P

Item	Title	Setting range	Description
CURR ADJ (F1)	Current Adjust	-200 to 200	Current offset

1P3W, 3P

Item	Title	Setting range	Description
U (F1)	U Current Adjust	-200 to 200	U-phase current offset
V (F2)	V Current Adjust		V-phase current offset
W ¹ (F3)	W Current Adjust		W-phase current offset

1. Only for the three-phase setting

Using the constant resistance (CR) function

The constant resistance (CR) function supplies current in proportion to changes in voltage. This function operates in CC+CR mode, supplying current in both constant current and constant resistance modes. To use only CR operation, set the current setting value to 0 A.

Equivalent circuit

Equivalent capacitance: C_{eqv}

Example:
EUT: 100 V
CR resistance (R): 10 Ω
Mode: CC Supply
Current setting: 5 A
Synchronization delay phase angle: 0 deg

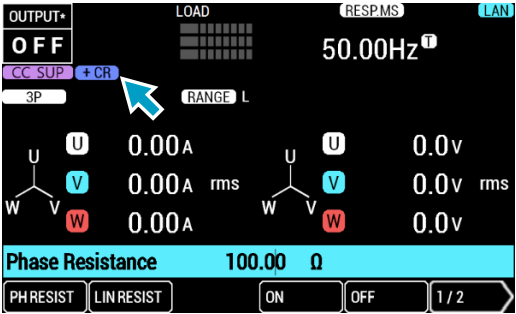
The figure shows the flow of current under the above conditions. A current of 10 A flows by CR operation with a resistance of 10 Ω , and a current of 5 A flows, in the cancellation direction, by CC operation with the current setting. A total current of 5 A is supplied from the EUT as a result.

Turning the CR function on and off

1 Switch the display screen using the following procedure:

Connection method	Setup procedure
1P	$I > 1/2 (F6) > CR (F4)$
1P3W	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4)$
3P	

2 Turning the CR function on and off



Item	Title	Description
ON (F4)	--	Using the CR Functions When CR is enabled, the "+CR" icon appears on the display.
OFF (F5)		CR function is not used (factory default setting).

This completes the setting.

Setting the CR function resistance value

NOTE

- If there are power modules that are paused by the power module management function, the resistance setting range is changed according to the number of power modules (power capacity) that are running.
- When the power module management setting is changed, the resistance values are reset to factory default settings.
- The resolution of the CR resistance value has a range that differs between the resolution that can be entered and the resolution that can actually be set. For details, see “Relationship between the setting resolution and the internal resolution of CR resistance value setting” (p.229).

1 Set the CR resistance value using the following procedure:

The resolution is 0.01 Ω .

If the phases have different resistance settings, the unbalance icon will appear. (p.86)

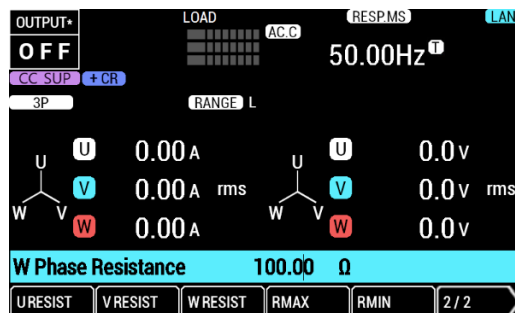
Wiring method	Phase to set	Setup procedure
1P	--	$I > 1/2 (F6) > CR (F4) > RESIST (F1)$
1P3W	All phases	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > PH RESIST (F1)$
	U-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > U RESIST (F1)$
	V-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > V RESIST (F2)$
	Line-to-line resistance ¹	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > LIN RESIST(F2)$
3P	All phases	$I > 1/4 (F6) > 2/4 (F6) > 3/4(F6) > CR (F4) > PH RESIST (F1)$
	U-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > U RESIST (F1)$
	V-phase	$I > 1/4(F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > V RESIST (F2)$
	W-phase	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > 1/2 (F6) > W RESIST (F3)$
	Line-to-line resistance ²	$I > 1/4 (F6) > 2/4 (F6) > 3/4 (F6) > CR (F4) > LIN RESIST (F2)$

1. When the line-to-line resistance value is changed, the resistance value of all phases is changed to half the line-to-line resistance value.
2. When the line-to-line resistance value is changed, the resistance value of all phases is changed to one-third of the line-to-line resistance value.

The setting range varies depending on the model, wiring method, and selected range.

See “Setting range” in the “Output” (p.214) section of the “Specifications” part.

For the factory default settings, see “Panel settings” (p.206)



2 Press ENT.

This completes the setting.

Using the Memory

NOTE

Pieces of memory data are saved for each operating mode.

Thus, the saved memory data cannot be recalled in an operation mode other than that in which the data were saved.

To recall the saved memory data, switch to the operation mode in which the data were saved.

For the procedure for saving to memory and the memory recall procedure, see “Using the Memory” in the User’s Manual.

Items that can be saved

■ Internal memory

The product has a preset memory and setup memory.

- Preset Memory

The following items can be saved to the internal preset memory(A, B, C).

- AC current setting value
- DC current setting value
- Frequency setting value
- waveform bank number

Memory contents can be easily recalled with a simple operation, which is useful when switching between three settings.

- Setup memory

Panel settings can be saved to the internal setup memory.

■ USB memory device

The following items can be saved to a USB memory device.

- Panel settings
- Sequence data
- Waveform bank data

Using the Compensation (Voltage compensation) Function

The compensation function compensates for voltage drops in the load cables when the load is connected to the product over a long distance. This product offers three types of sensing: hard sensing, soft sensing, and regulation adjust, but only hard sensing is available in CC Supply mode.

■ Hard sensing

Connect the EUT to the SENSING terminal of this product. Hard sensing is effective when using the CR function to supply current considering voltage drop.

Hard sensing can compensate the voltage up to approximately 1.5 V for a single line.

Hard sensing wiring

For details, see “Using the Compensation (Voltage Compensation) Function” in the User’s Manual.

Using the Harmonic Analysis Function

For details, see “Using the Harmonic Analysis Function” in the User’s Manual.

Using special waveforms (waveform bank)

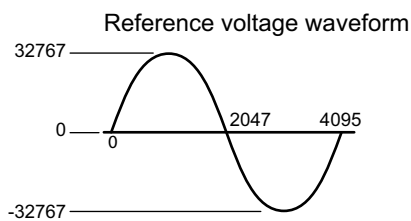
Peak clipped and flat curve waveforms are available.

You can use remote control to configure user-defined waveforms. For details, see the communication interface manual.

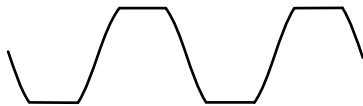
This product creates reference waveforms for output voltage by performing D/A conversion on the data that is stored in its internal memory.

One cycle (360° phase angle) consists of 12 bits horizontally and 16 bits vertically.

The reference voltage waveform of the PCR-WEA Series is a sine wave. A sine wave whose positive peak is 32767 and negative peak is -32767 is assigned.



Peak clipped waveforms, flat curve waveforms



If the peak is set within the ± 32767 range, it will be corrected internally by this product. To use more accurate waveforms, it is recommended to utilize the full ± 32767 peak range.

■ Waveform bank

The stored waveform data in memory that corresponds to one waveform is referred to as a waveform bank. This product has 257 waveform banks. You can number the banks from 0 to 256 and select the desired waveform by one of these numbers. The waveform banks are stored for each operation mode. Waveform bank 0 consists of calculated sine wave data with a phase setting resolution of 0.01° . This bank cannot be overwritten.

By factory default, sine waves are preset for all waveform banks.

■ Peak-clipped waveform

The peak portion of waveforms is clipped by the specified crest factor value. The sine waveform is adjusted so that the specified rms value and the rms value of the waveform that is actually input are the same.

The crest factor is the ratio of the AC waveform's peak value to its rms value.

Crest factor = peak value / rms value.

For a sine wave, the crest factor is 1.41. In the voltage waveforms of commercial power lines, the peaks are clipped, so the crest factor is between 1.2 and 1.4.

■ Flat curve waveform

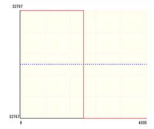
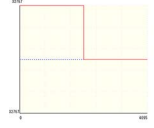
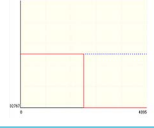
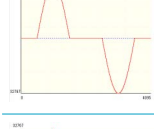
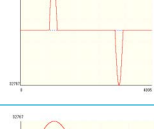
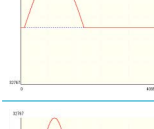
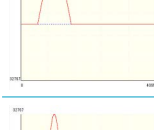
This is a waveform defined in IEC61000-4-13.

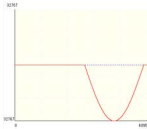
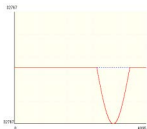
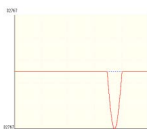
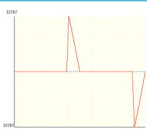
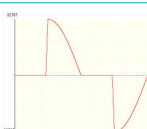
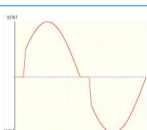
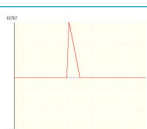
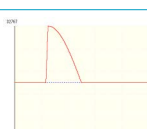
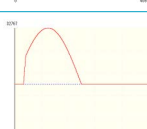
The peak of the waveform is clipped by the specified clip factor (the waveform peak is defined to be 1).

The specified rms value and the rms value of the waveform that is actually input are not the same.

Sample waveforms

Sample waveforms are preset in the waveform banks. To use a sample waveform, select its waveform bank number.

Waveform bank number	Waveform information	
236	Square wave	Full wave 
237		Upper half wave 
238		Lower half wave 
239	Triangular	Full wave 
240	Capacitor input CF=1.5	Full wave 
241	Capacitor input CF=2.0	
242	Capacitor input CF=3.0	
243	Capacitor input CF=4.0	
244	Capacitor input CF=1.5	Upper half wave 
245	Capacitor input CF=2.0	
246	Capacitor input CF=3.0	

Waveform bank number	Waveform information	
247	Capacitor input CF=1.5	Lower half wave 
248	Capacitor input CF=2.0	
249	Capacitor input CF=3.0	
250	Phase control 30 deg	Full wave 
251	Phase control 90 deg	
252	Phase control 150 deg	
253	Phase control 30 deg	Upper half wave 
254	Phase control 90 deg	
255	Phase control 150 deg	
256	Harmonics (10th, 10%)	Full wave 

Creating a waveform bank

Waveform banks cannot be created while using the external analog input function (EXTDC).

- 1 Press OTHERS (SHIFT+MEMORY) > WAVE (F2) > EDIT (F5).**
- 2 EWB No.Press (F1) to select the waveform bank number to be created (1 to 235).**

Waveform bank numbers 236 to 256 cannot be edited because they contain preset sample waveforms.

- 3 Select the waveform.**

If you select the peak clipped waveform, also set the crest factor.

If you select the flat curve waveform, also set the clip factor.

Item	Title	Description
SIN (F3)	Edit WB No.	Selects the sine wave
P.C (F4)		Sets the crest factor of the peak-clipped waveform (1.10 to 1.40).
FLT.C (F5)		Sets the clip factor (0.4 to 1.0) of the flat curve waveform.

- 4 Press APPLY (F4).**

This completes the setting. To cancel, press CANCEL (F5).

Setting special waveforms

NOTE

The power may be supplied in the opposite direction (from the EUT to the product) depending on special waveforms (waveform banks) to be used. To prevent the operation of the EUT from being affected, check the setting details of a waveform in advance.

You cannot change the waveform bank number while a soft start is being performed, a soft stop is being performed, or when the product is being controlled by an external analog signal and the signal source is set to external signal (EXT) only.

■ Single-phase, single-phase three-wire, two-phase, three-phase (setting all phases collectively)

1 Press OTHERS (SHIFT+MEMORY) > WAVE (F2) to select the waveform bank number.

“S.WAVE” is displayed in the following cases.

Single-phase or single-phase three-wire connection: The waveform bank number must be other than 0.

Two-phase connection: The waveform bank number must be other than 0 for all U- and V-phases.

Three-phase connection: The waveform bank number must be other than 0 for all U-, V-, and W-phases.

Item	Title	Description
WB No. (F1)	WB No.	Specifies the waveform bank number to be used (0 to 256).

2 Press APPLY (F4).

To cancel, press CANCEL (F5).

This completes the setting.

■ Setting each phase individually for two- and three-phase configurations

1 Press OTHERS (SHIFT+MEMORY) > WAVE (F2) > 1/2 (F6) to select the waveform bank number for each phase.

“S.WAVE” is displayed in the following cases.

Two-phase connection: The waveform bank number must be other than 0 for all U- and V-phases.

Three-phase connection: The waveform bank number must be other than 0 for all U-, V-, and W-phases.

Item	Title	Description
U WB No. (F1)	U WB No.	Specifies the waveform bank number to use for the U-phase(0 to 256).
V WB No. (F2)	V WB No.	Specifies the waveform bank number to use for the V-phase(0 to 256).
W WB No. (F3)	W WB No.	Specifies the waveform bank number to use for the W-phase(0 to 256).

2 Press APPLY (F4).

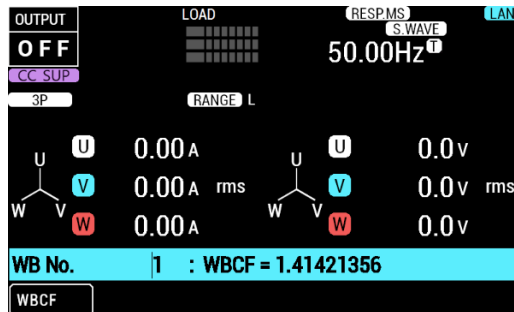
To cancel, press CANCEL (F5).

This completes the setting.

Displaying the crest factor of a special waveform

1 Press OTHERS (SHIFT+MEMORY) > WAVE (F2) > WBCF (F4).

2 Select the waveform bank for which to display the crest factor.



Stop using a special waveform (revert to sine wave)

To stop using a special waveform, set the waveform bank number to 0.

Configuring Soft Start and Soft Stop

CC Supply mode allows soft start and soft stop settings for the current and CR resistance values.
When OUTPUT is turned on/off, the following operations occur:

■ soft start

- Current: The current value gradually increases from 0 A.
- CR resistance: The resistance value gradually decreases from $\infty \Omega$.

■ Soft stop

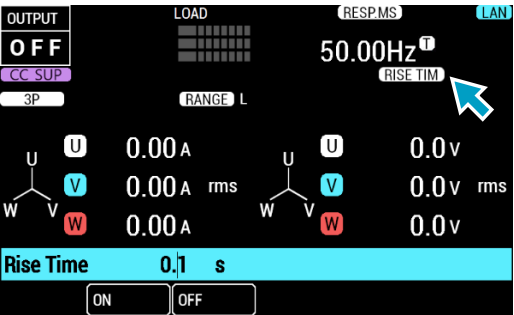
- Current: The current value gradually decreases to 0 A.
- CR resistance: The resistance value gradually increases to $\infty \Omega$.

When you set soft start to on, "RISE TIM" will be displayed.
When you set soft stop to on, "FALL TIM" will be displayed. While the soft stop is in operation, "OFF" of OUTPUT OFF blinks.
The OUTPUT key is invalid when soft stop is being performed.

Configuring soft start

1 Press OTHERS (SHIFT+MEMORY) > RISE TIM (F1) to configure soft start.

If you select ON, "RISE TIM" will be displayed.

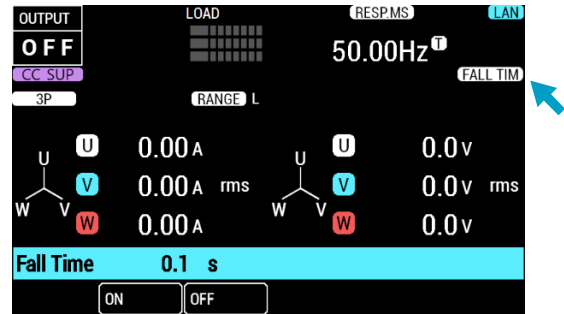


Item	Title	Description
ON (F2)	Rise Time	Sets the rise time (0.1 s to 30.0 s). Enables soft start
OFF (F3)		The soft start function is turned off.

This completes the setting.

Configuring soft stop

- Press OTHERS (SHIFT+MEMORY) > 1/2 (F6) > FALL TIM (F1) to configure soft stop.**
 If you select ON, "FALL TIM" will be displayed.



Item	Title	Description
ON (F2)	Fall Time	Sets the fall time (0.1 s to 3.0 s). Enables soft stop
OFF (F3)		Soft stop off

This completes the setting.

Using the Power Management Functions

The PCR-WEA Series has the following two power management functions: a sleep function and a power-saving function

For details, see "Using the Power Management Functions" in the User's Manual.

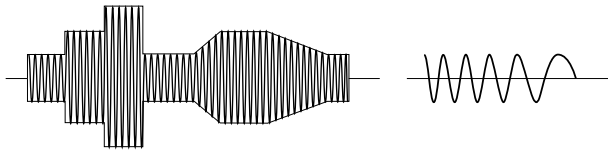
NOTE

- If the following functions are turned on in the CC+CR mode, the CR mode will be automatically canceled.
 - Power-saving function (Power Save)
 - Power module management function
- If the sync function is turned on, the sleep function will not be activated.

Sequence Function

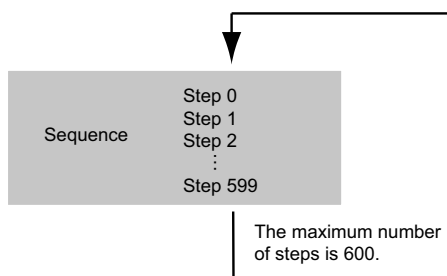
Sequence Overview

A sequence is a function that automatically operates by recalling pre-stored combinations of settings in sequence, such as current, frequency, and time.



Sequences are groups of executable units called steps. When a sequence is executed (run), its steps are executed in order, starting with the specified starting step. A single execution of a sequence is completed after the sequence's specified last step has been executed.

You can use the jump function to skip steps and repeatedly execute all the steps in the sequence except for those that have been skipped.



First, set the starting step, and then set the sequence conditions.

When a sequence is completed, the product's settings are those of the last step. If the output is on in the last step of the sequence and you want to turn the output off when the sequence ends, you must add an output off step at the end.

The step editing screens consist of seven pages for single-phase output and eight pages for each of single-phase three-wire output and three-phase output. The following table shows the parameters that can be set in each step and on what page it can be set.

Parameter that can be set in a step	Step editing screen		
	1P	1P3W	3P
Frequency	Page 1	Page 1	Page 1
Frequency signal change	Page 1	Page 1	Page 1
AC current (of all phases)	Page 1	Page 1	Page 1
AC current of each phase	--	Page 1	Page 1
AC current signal change	Page 1	Page 1	Page 1
Step execution time	Page 2	Page 2	Page 2
Number of the waveform bank to use	Page 2	Page 2	Page 2
Output on/off	Page 3	Page 3	Page 3
DC current (of all phases)	Page 3	Page 3	Page 3
DC current of each phase	--	Page 3	Page 3
DC current signal change	Page 3	Page 3	Page 3
Status output	Page 4	Page 4	Page 4
Trigger output	Page 4	Page 4	Page 4
Trigger input	Page 4	Page 4	Page 4
Jump function	Page 5	Page 5	Page 5
Starting phase angle	Page 6	Page 6	Page 6
Ending phase angle	Page 6	Page 6	Page 6
Sudden phase change	Page 6	Page 6	Page 6
CR resistance (of all phases)	Page 7	Page 8	Page 8
CR resistance of each phase	--	Page 8	Page 8
CR phase change	Page 7	Page 8	Page 8
U-phase offset	--	--	Page 7
U-phase change	--	--	Page 7
UV phase difference	--	Page 7	Page 7
V-phase change	--	--	Page 7
UW phase difference	--	--	Page 7
W-phase change	--	--	Page 7

Signal change (ramp) of a step

To change (sweep) the frequency or current linearly over the specified time, select "RAMP ON." To change the value as a step, select "RAMP OFF." If you specify "RAMP ON" in step 0, the signal of current will change linearly from the present current or frequency.

When the ramp is off

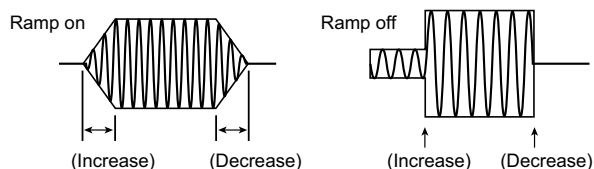
When the ramp is on

EP	FREQ	ACI U	ACI V	ACI W
01	50.00Hz	0.00A	0.00A	0.00A
02	50.00Hz	0.00A	0.00A	0.00A
03	50.00Hz	0.00A	0.00A	0.00A
04	50.00Hz	0.00A	0.00A	0.00A
05	50.00Hz	0.00A	0.00A	0.00A

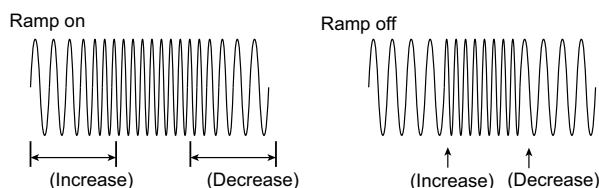
Step 002

STEP FREQ ACI ACI V ACI W 1/8

- Current signal change



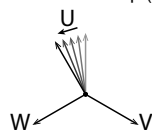
- Frequency signal change



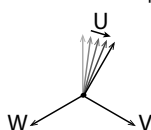
- Phase signal change

For three-phase output, you can set the phase ramp (leading or lagging).

Advance the phase over the duration of the step (LEAD)



Delay the phase over the duration of the step (LAG)



Signal output and Resuming

If the status signal is enabled, a status signal will be output while a step is being executed.

If the trigger signal output is enabled, a signal is output for several tens of microseconds when a step is executed.

You can apply a trigger signal to resume a paused sequence.

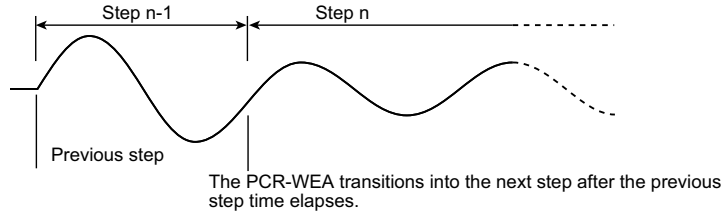
Starting phase angle and ending phase angle

Steps are managed in terms of time.

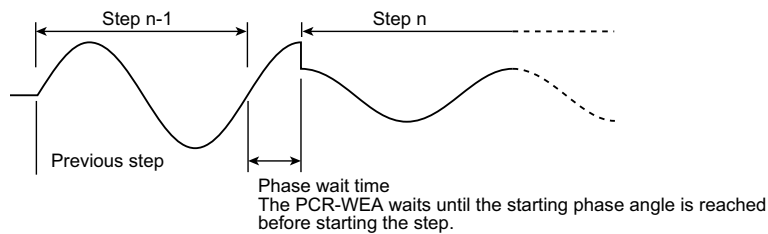
If you set the starting phase angle, steps will start from the specified phase angle.

Phase wait time is the duration from the point when the step time of the last step has elapsed to the point where the phase angle reaches the starting phase angle. The phase wait time is dependent on frequency.

When starting phase angle is not specified (S.PHASE=FREE)



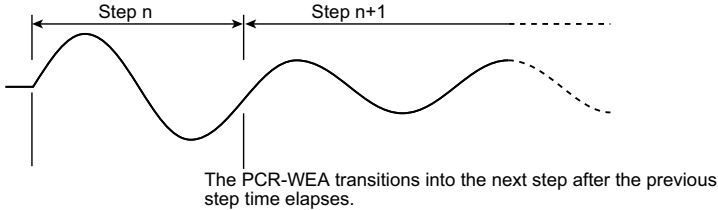
When the starting phase angle is set to 90° (S.PHASE=90 deg)



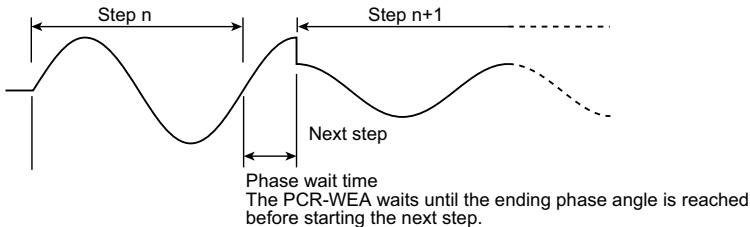
If you set the ending phase angle, the PCR-WEA series will end the step when the specified phase is reached.

Phase wait time is the duration from the point when the step time has elapsed to the point where the phase angle reaches the ending phase angle. The phase wait time is dependent on frequency.

When End [deg] is not set (E.PHASE=FREE)



When End [deg] is set to 90° (E.PHASE=90 deg)



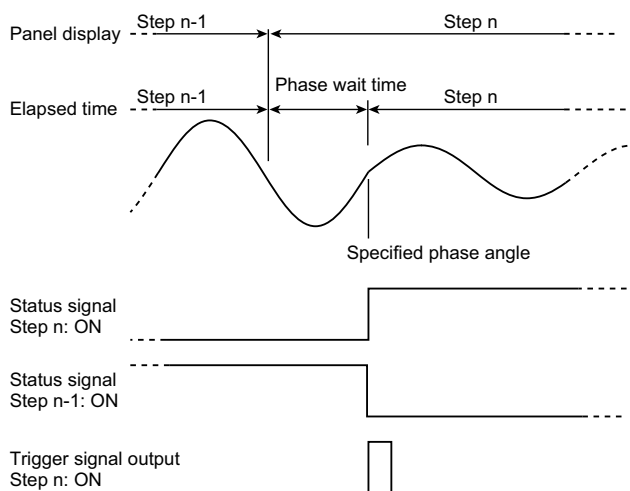
You can output the same waveform regardless of whether you set the starting phase angle or the ending phase angle.

When a waveform is to be output continuously (the phase does not change suddenly) and you set both the starting and ending phase angles, the waveform may be offset by one period. To avoid confusion, we recommend that you set the starting phase angle and not the ending phase angle (FREE).

Display and signal output during the phase wait time

During the phase wait time, the screen shows the next step number. The elapsed time remains at zero until the next step starts.

The status signal is output while the waveform of the step that is enabled is being output.



Sudden phase change

If you set both the starting and ending phase angles and specify sudden phase change, the phase will suddenly change.

If you set sudden phase change to ON, you can switch between two steps according to the set phase angles. For example, if you set the step n-1's ending phase angle to 90° , the step n's starting phase angle to 270° , and set sudden phase change to ON, when the step time of step n-1 elapses and the phase reaches 90° , a transition is made to step n (a phase angle of 270°).

Jump function

The steps in a sequence are normally executed in order starting with the starting step. However, you can use the jump function to skip over steps and repeat sets of steps by repeatedly executing jumps.

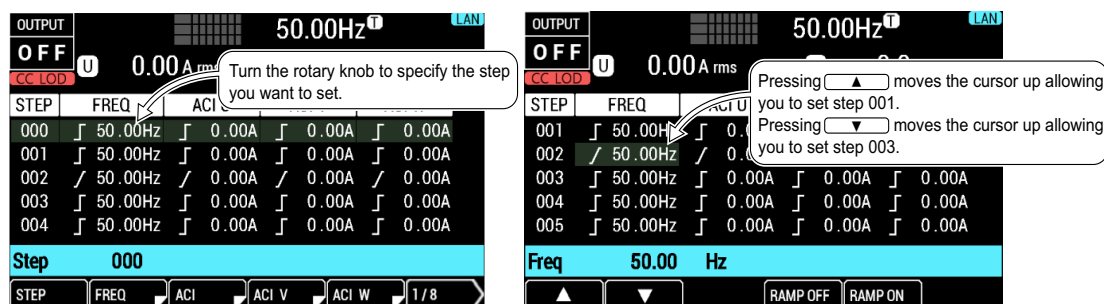
Editing steps

The step editing screens consist of seven pages for single-phase output and eight pages for each of single-phase three-wire output and three-phase output.

The number [x] before each title indicates the page number of the step editing screen.

Press SEQ (SHIFT+SIM) > EDIT (F5) to display the step editing screen.

Common items



Item	Title	Description
STEP (F1)	STEP	Specifies the step (0 to 599) that you want to configure.
▲ (F1)	—	Sets the previous step as the one that you want to configure
▼ (F2)	—	Sets the next step as the one that you want to configure

[1] Frequency and AC current

Set the frequency and AC current. The signal change of a step can also be set for frequency and the AC current.

If setting the current of each phase for single-phase three-wire connection or three-phase connection, set ACI (F3) first to set the currents of all phases at the same time. Then, set ACI V (F4) and ACI W (F5) to set for the V-phase and W-phase, respectively. The signal change of AC current applies to all phases.

Item	Title	Description
FREQ (F2)	Freq	Sets the step frequency.
	RAMP OFF (F4)	Disables the ramped frequency signal change
	RAMP ON (F5)	Enables the ramped frequency signal change
ACI (F3)	AC PhaseCurr	Sets the AC current of a step.
	RAMP OFF (F4)	Sets the AC current signal change to ramp off.
	RAMP ON (F5)	Sets the AC current signal change to ramp on.
ACI V (F4)	AC V PhaseCurr	Sets the AC current of a step (V-phase).
	RAMP OFF (F4)	Sets the AC current signal change to ramp off.
	RAMP ON (F5)	Sets the AC current signal change to ramp on.
ACI W (F5)	AC W PhaseCurr	Sets the AC current of a step (W-phase).
	RAMP OFF (F4)	Sets the AC current signal change to ramp off.
	RAMP ON (F5)	Sets the AC current signal change to ramp on.

[2] Execution time, waveform bank

Set the step execution time and waveform bank.

If setting the waveform bank of each phase for single-phase three-wire (two-phase) connection or three-phase connection, set WB NO (F3) first to set the waveform banks of all phases at the same time. Then, set V WB NO (F4) and W WB NO (F5) to set for the V-phase and W phase, respectively.

Item		Title	Description
TIME (F2)	HOUR (F3)	Time (HOUR)	Sets the step time's hours (0 hours to 1000 hours).
	MIN (F4)	Time (MIN)	Sets the step time's minutes (0 minutes to 59 minutes).
	SEC (F5)	Time (SEC)	Sets the step time's seconds (0 seconds to 59 seconds).
	100 US (F6)	Time (100 us)	Sets the step time in microseconds in 100 μ s increments (0 μ s to 999900 μ s).
WB NO (F3)		WB No.	Sets the waveform bank number to use.
V WB NO (F4)		V WB No.	Sets the waveform bank number to use for the V-phase.
W WB NO (F5)		W WB No.	Sets the waveform bank number to use for the W-phase.

[3] DC current, output

Set the DC current and output. The step signal change can also be set for DC current.

If setting the current of each phase for two-phase connection or three-phase connection, set DCI (F3) first to set the currents of all phases at the same time. Then, set DCI V (F4) and DCI W (F5) to set for the V-phase and W-phase, respectively. DC current signal change applies to all phases.

For single-phase three-wire connection, set DCI (F3) to set the current of the U-phase. For the V-phase, the value of the reverse polarity is automatically output.

Item		Title	Description
OUTPUT (F2)	OFF (F4)	Output	Turns output off (Load Off for CC Load).
	ON (F5)		Turns output on (Load On for CC Load).
DCI (F3)		DC PhaseCurr	Sets the step's DC current.
	RAMP OFF (F4)		Sets the DC current signal change to ramp off.
	RAMP ON (F5)		Sets the DC current signal change to ramp on.
DCI V (F4)		DC V	Sets the DC current of the step (V-phase)
	RAMP OFF (F4)	PhaseCurr	Sets the DC current signal change to ramp off.
	RAMP ON (F5)		Sets the DC current signal change to ramp on.
DCI W (F5)		DC W	Sets the DC current of a step (W-phase)
	RAMP OFF (F4)	PhaseCurr	Sets the DC current signal change to ramp off.
	RAMP ON (F5)		Sets the DC current signal change to ramp on.

[4] Status output, trigger output, trigger input (pause)

WARNING

Risk of electric shock.

Use the DIGITAL I/O connector with an isolation voltage of 42 V_{peak} or less.

Set the status signal output, trigger signal output, and trigger signal input wait.

Set the signal polarity with the external control function.

Item		Title	Description
STAT.OUT (F2)	OFF (F4)	Status Out	Sets the status signal output to off
	ON (F5)		Sets the status signal output to on
TRIG.OUT (F3)	OFF (F4)	Trig Out	Set the trigger signal output to off
	ON (F5)		Set the trigger signal output to on
TRIG.IN ¹ (F4)	OFF (F4)	Trig In	Disables trigger signal input wait
	ON (F5)		Enables trigger signal input wait (pause)

1. When TRIG.IN is set to ON, set S.PHASE and E.PHASE to "FREE" and PHASE.CHG to "OFF."
If S.PHASE and E.PHASE are set to "FIXED" and PHASE.CHG is set to "ON" in the same step, the sequence cannot be executed.
For details on how to set S.PHASE, E.PHASE, and PHASE.CHG, see "[6] Starting phase angle, ending phase angle, sudden phase change" (p. 142).

The DIGITAL I/O connector is isolated from the product's INPUT and OUTPUT terminal blocks. The common line of the TRIG and STAT signals is shared internally, so it is not isolated.

If the signal line that is connected to the connector has an electrical potential compared to ground, the connected device or the product may be damaged when a current flows through the signal line.

■ Status signal output (STAT.OUT)

When the status signal output is turned on, the signal is output only while the step's waveform is being output.

Use Monitoring the operation status (p. 190) or Selectable I/O (p. 193) to map the status output (SEQ Status Out) to a channel.

■ Trigger signal output (TRIG.OUT)

When the trigger signal output is turned on, the signal is output for several tens of microseconds when a step is executed.

Use Selectable I/O (p. 193) to map the trigger output (SEQ Trigger Out) to a channel.

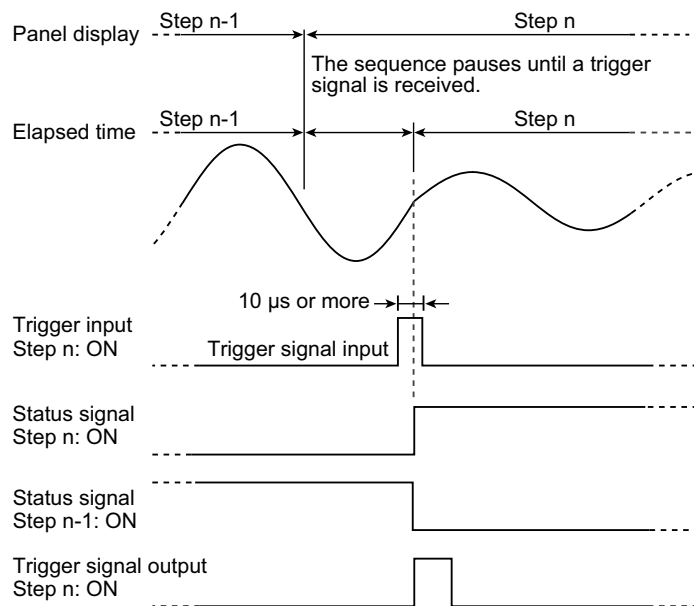
There is a time difference of approximately 100 μs between the trigger signal output and changes to the actual output.

■ Trigger input (TRIG.IN)

When the trigger input is turned on, the sequence is paused after the previous step is finished, and the product enters a trigger input wait state. If a trigger signal (pulse width of at least 10 μs) is applied through the DIGITAL I/O terminal, the pause is released and the step is executed.

Use Selectable I/O (p. 193) to map the trigger input (SEQ Trigger In) to a channel.

During the trigger input wait time, the screen shows the next step. The elapsed time remains at zero until the next step starts.



[5] Jump function

Set whether to skip over steps or repeat jumps.

Item		Title	Description
TYPE (F2)	NORM (F4)	Step Type	After this step is completed, the subsequent step will be executed.
	JUMP (F5)		After this step is completed, the specified step will be executed.
JUMP STEP (F3)		Jump Step	Sets the jump destination step (0 to 599).
JUMP CNT (F4)		Jump Count	Sets the number of jump repetitions (1 to 99999; 99999 indicates unlimited repetitions).

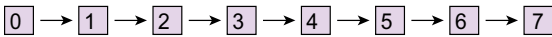
Jump function

The steps in a sequence are normally executed in order starting with the starting step. However, you can use the jump function to skip over steps and repeat sets of steps by repeatedly executing jumps.

- Example of not using the jump function

If you set TYPE to NORM, both JUMP STEP and JUMP CNT will be disabled.

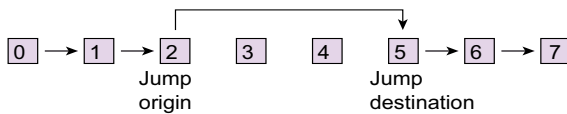
Step	TYPE	JUMP STEP	JUMP CNT
0 to 7	NORM	0	1

Steps 

The steps are executed in order.

- Example of using the jump function (skipping steps)

Step	TYPE	JUMP STEP	JUMP CNT
0, 1, 3 to 7	NORM	0	1
2	JUMP	5	1

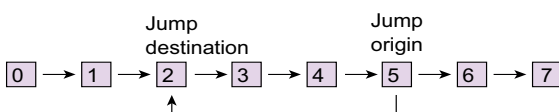
Steps 

The execution jumps over steps 3 and 4.

The step execution order is 0→1→2→5→6→7.

- Example of using the jump function (repeating steps)

Step	TYPE	JUMP STEP	JUMP CNT
0 to 4, 6, 7	NORM	0	1
5	JUMP	2	2

Steps 

The execution jumps from step 5 to step 2.

Order of step execution:

0→1→2→3→4→5→2→3→4→5→2→3→4→5→6→7

[6] Starting phase angle, ending phase angle, sudden phase change

Set the starting phase angle, ending phase angle, and sudden phase change.

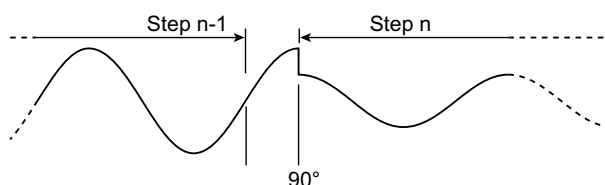
Item		Title	Description
S.PHASE ¹ (F2)	FREE (F5)	Start Phase	Does not set the starting phase angle
	FIXED (F4)		Sets the starting phase angle (0.0 deg to 360.0 deg, 0=360).
E.PHASE ¹ (F3)	FREE (F5)	End Phase	Does not set the ending phase angle
	FIXED (F4)		Sets the ending phase angle (0.0 deg to 360.0 deg, 0=360).
PHAS.	OFF (F4)	Phase Change	Disables sudden phase change
CHG ¹ (F4)	ON (F5)		Enables sudden phase change

1. If S.PHASE and E.PHASE are set to "FREE" and PHASE.CHG is set to other than "OFF," set TRIG.IN to "OFF." If TRIG.IN is set to "ON" in the same step, the sequence cannot be executed.
For details on how to set TRIG.IN, see "[4] Status output, trigger output, trigger input (pause)" ([page 139](#)).

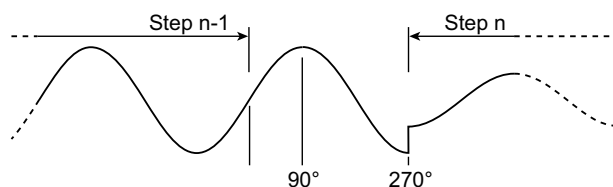
NOTE

Setup example for making sudden phase changes

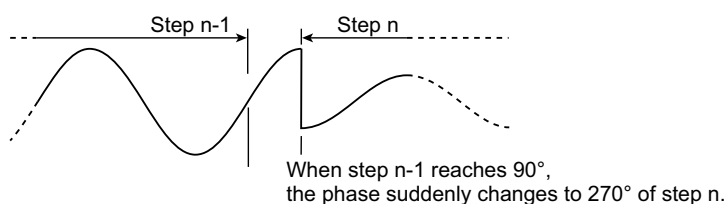
First, set the ending phase angle of the step immediately before the sudden phase change to 90°. If the sudden phase change is set to off, the sequence moves to the next step when the phase angle reaches 90° after the step time of the previous step elapses, as shown below.



Next, set the starting phase angle of the step where you want to perform the sudden phase change to 270°. Even when the phase angle reaches 90° after the step time of the previous step elapses, the sequence does not move to the next step. The sequence moves to the next step when the phase angle reaches 270°.



Lastly, set the sudden phase change to on. When the phase angle of the previous step reaches 90°, the sequence changes to the next step. The next step begins at 270°.



[7] CR (for single-phase connection)

Set the resistance value of CR (constant resistance) and the signal change of a step.

NOTE

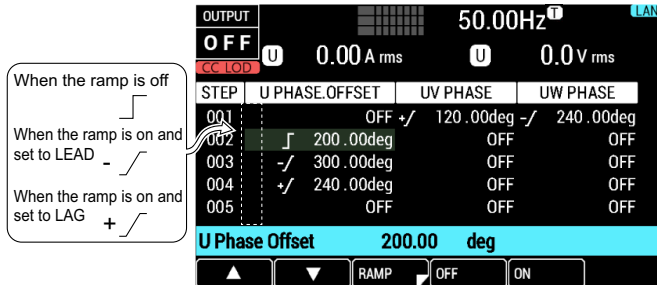
If the product is sanitized ([p.206](#)), the CR resistance of a step shows N/ A.
Turn CR on to set a resistance.

Item		Title	Description
CR (F2)	OFF (F4)	CR	Does not set CR.
	ON (F5)		Sets CR.
RESIST (F3)		Phase	Sets the CR resistance of a step.
	RAMP OFF (F4)	Resistance	Sets the CR resistance signal change to ramp off.
	RAMP ON (F5)		Sets the CR resistance signal change to ramp on.

[7] Phase difference setting (two-/ three-phase connection)

Set the U-phase offset phase angle and the phase differences of the V-phase and W-phase relative to the U-phase. Also set the step's signal change.

Set this when only one or two phases are to change suddenly or when performing a phase sweep.

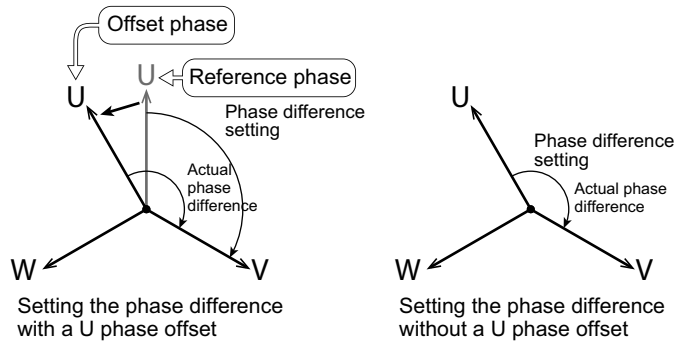


Item	Title		Description
U PHA.OFFS (F2) ¹	RAMP (F3) ²	LEAD (F4)	U Phase Offset
		LAG (F5)	Sets the U-phase change to lagging (phase sweep)
		RAMP	Disables the ramped U-phase change
		OFF (F3)	(sudden phase change)
		OFF(F4)	Disables the U-phase offset.
UV PHASE (F2/F3 ³)	RAMP (F3) ²	LEAD (F4)	UV Phase
		LAG (F5)	Sets the V-phase change to lagging (phase sweep)
		RAMP	Disables the ramped V-phase change
		OFF (F3)	(sudden phase change)
		OFF (F4)	The phase difference between U-V is not set. The phase will not change from the previous step.
UW PHASE (F4) ¹	RAMP (F3) ²	LEAD (F4)	UW Phase
		LAG (F5)	Sets the W-phase change to lagging (phase sweep)
		RAMP	Disables the ramped W-phase change
		OFF (F3)	(sudden phase change)
		OFF (F4)	The phase difference between U-W is not set. The phase will not change from the previous step.
	ON (F5)		Sets the U-V phase difference (-360.00 deg to 360.00 deg). Resolution: 0.01
			Sets the U-W phase difference (-360.00 deg to 360.00 deg). Resolution: 0.01

1. Three-phase connection
2. When ON (F5) is selected
3. F2 for two-phase connection, F3 for three-phase connection

U-phase offset setting.

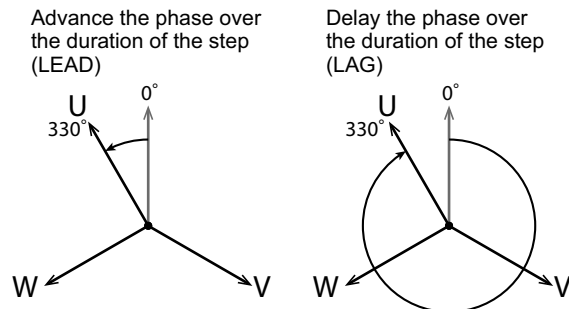
If you set the U-phase offset, the U-phase will be offset from the reference phase. As a result, the U-V/U-W phase difference settings will be offset from the actual phase difference.



To avoid confusion, we recommend that you turn off the U-phase offset when you use the phase sweep feature. For details, see “Sudden phase change for multi-phase output ([p.161](#))” in the sequence tutorial.

Ramp setting

Phase ramp can be set to leading (LEAD) or lagging (LAG). This is effective for varying the line voltage.



Set an absolute angle for the phase angle.

For details, see “Phase sweep” in the sequence tutorial ([p.165](#)).

[8] CR (single-phase three-wire/two-phase/three-phase connection)

Set the resistance value of CR (constant resistance) and the signal change of a step.

NOTE

If the product is sanitized ([p.206](#)), the CR resistance of a step shows N/ A.
Turn CR on to set a resistance.

To set the resistance of each phase, set RESIST (F3) first to set the resistances of all phases at the same time. Then, set RESIST V (F4) and RESIST W (F5) to set the resistances of the V-phase and W-phase, respectively. The resistance change characteristics are the same for all phases.

Item		Title	Description
CR (F2)	OFF (F4)	CR	Does not set CR.
	ON (F5)		Sets CR.
RESIST (F3)		Phase	Sets the CR resistance of a step.
	RAMP OFF (F4)	Resistance	Sets the CR resistance signal change to ramp off.
	RAMP ON (F5)		Sets the CR resistance signal change to ramp on.
RESIST V (F4)		V Phase	Sets the CR resistance of a step (V-phase).
	RAMP OFF (F4)	Resistance	Sets the CR resistance signal change to ramp off.
	RAMP ON (F5)		Sets the CR resistance signal change to ramp on.
RESIST W (F5)		W Phase	Sets the CR resistance of a step (W-phase).
	RAMP OFF (F4)	Resistance	Sets the CR resistance signal change to ramp off.
	RAMP ON (F5)		Sets the CR resistance signal change to ramp on.

Setting sequence conditions

The items that you set here are shared between all steps.

Setting the starting step number and the ending step number

On the sequence screen, press COND (F4) to set the starting step number and the ending step number (starting step number < ending step number).

Item	Title	Description
START STEP	Start Step	Sets the starting step number (0 to 599).
END STEP	End Step	Sets the ending step number (0 to 599).

Setting the number of repetitions

On the sequence screen, press LOOP(F3) to set the number of times that the sequence will be repeated.

Item	Title	Description
LOOP (F3)	Loop	Sets the number of repetitions (1 to 99999, where 99999 indicates unlimited repetitions).

Setting the control logic of the trigger and status output

To use status output, you need to map the status signal output to the DIGITAL I/O terminal pins. For details, see Monitoring the operation status ([p.190](#)) or Selectable I/O ([p.193](#)).

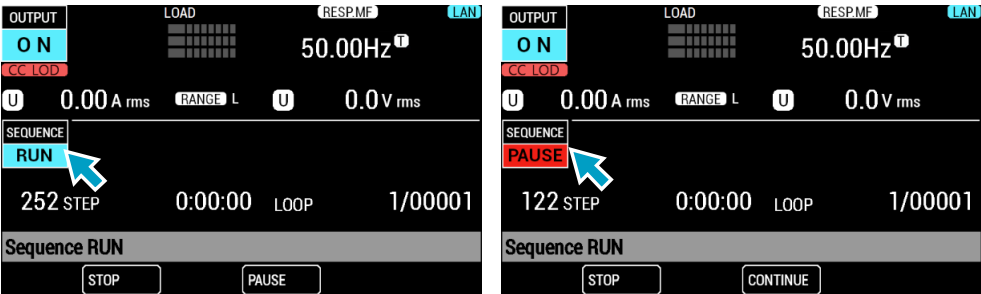
To use triggers, you need to map the trigger I/O to the DIGITAL I/O terminal. For details, see Selectable I/O ([p.193](#)).

Executing, Pausing, and Stopping Sequences

After you have finished setting the steps and the sequence conditions, you can execute the sequence. Press SEQ (SHIFT + SIM) > RUN(F1) to run the sequence.

You cannot run a sequence in the following situations.

- The range is set to the L range, and there is a step whose current exceeds the current setting range (switch the range to the H range, or set the current so that it is within the L range).
- The current or frequency is set to a value outside the corresponding limits.
- There is a step where the trigger wait setting (TRIG.IN) and the sudden phase change setting (PHAS.CHG) are both turned on.
- The external analog input function (VPROG) is in use.
- The external analog input function (EXTDC) is in use, and the signal source is EXT.
- Soft start and soft stop is in progress.



Item	Title	Description
STOP (F2)	Sequence	Stops the running sequence (the output remains in the state of step being run).
PAUSE (F4)		Pauses a sequence that is being executed
CONTINUE (F4)		Resumes a sequence that has been paused

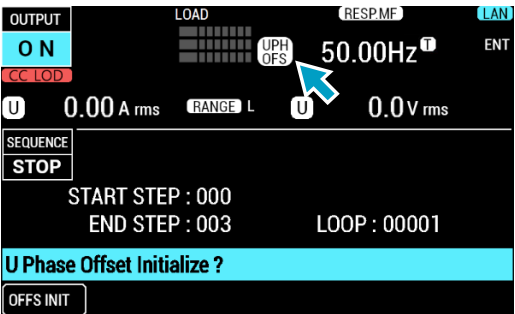
You can also resume the execution of a paused sequence by applying a trigger signal.

Press OUTPUT while a sequence is running to stop the sequence with the output turned off.

A sequence is complete when all steps are complete. When a sequence is completed, the product's settings are those of the last step.

If the output is on in the last step of the sequence and you want to turn the output off when the sequence ends, you must add an output off step at the end.

If the U phase is offset in the last step of the sequence, the offset (the U PH OFS icon) will remain even when the sequence is complete.

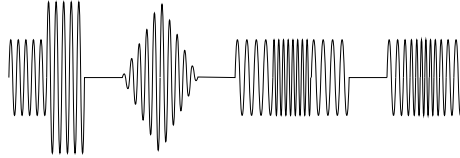


Sequence Creation Tutorial

The following information will be explained.

- Sequence creation basics (p. 150)

Describes basic sequence settings (current, frequency, and ramp).



- Current sweep and frequency sweep (p. 153)

Describes how to sweep a waveform using the ramp function.



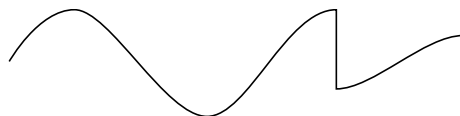
- Switching steps at specific phase angles (p. 154)

Describes how to start subsequent steps from specified angles after previous steps are completed. The phase still continues.



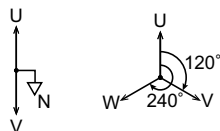
- Suddenly changing the phase (p. 157)

Describes how to suddenly change the phase between steps.



- Single-phase three-wire output and three-phase output basics (p. 159)

Describes the waveforms that are produced for single-phase three-wire output and three-phase output.



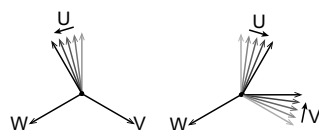
- Sudden phase change for multi-phase output (p. 161)

Describes how to set a sequence so that the phase suddenly changes for multi-phase output.



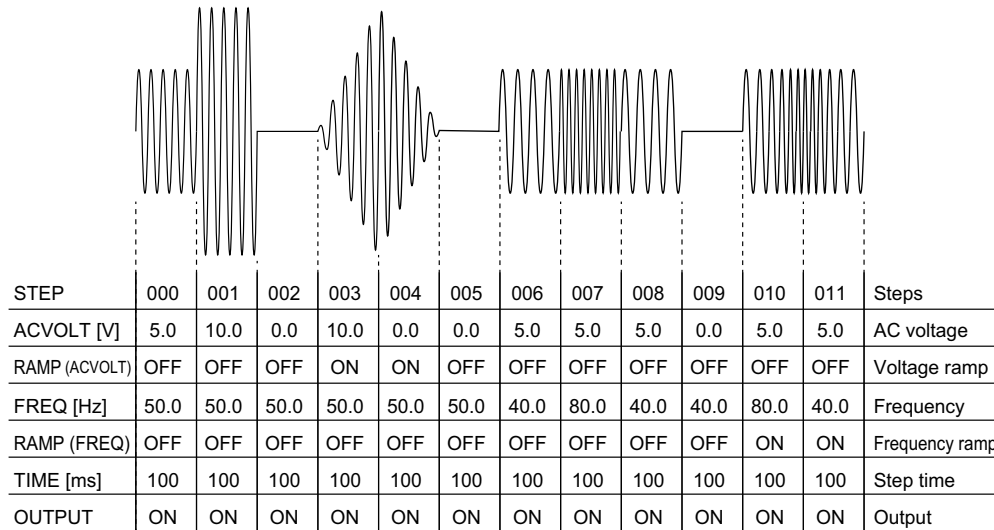
- Phase sweep (p. 165)

Describes how to set a sequence so that the phase is swept for multi-phase output.



Sequence creation basics

This section explains how to use a sequence to output the following waveform.



Setting procedure

Use the rotary knob or the numeric keypad enter values for items that you want to set. When using the numeric keypad, press ENT after you enter values.

1 Press SEQ(SHIFT+SIM) > EDIT (F5) to display the step editing screen.

The background color of the step where you can set content will change.

■ Moving to a step to be edited

1 You can move to the step to be edited with the rotary knob or by pressing STEP (F1).

A border will appear around the step to be edited.

■ Setting the current

1 Press ACI (F3) for a step to be edited to set an AC current.

2 Press RAMP OFF (F4) or RAMP ON (F5) to set the current ramp.

The current changes from 0.0 A to 10.0 A over 100 ms in step 003, and it changes from 10.0 A to 0.0 A over 100 ms in step 004. This is because the current ramp is set to on. Press RAMP ON (F5) to change the ramp indication of current to .

3 Press ▲ or ▼ to move to another step and set the current of the step.

4 Press ESC to return to the previous screen.

■ Setting the frequency

- 1** Press **FREQ (F2)** for a step to be edited to set the frequency.
The default frequency is 50.0 Hz.
- 2** Press **RAMP OFF (F4)** or **RAMP ON (F5)** to set the frequency ramp.
In step 010, the frequency changes from 40 Hz to 80 Hz over 100 ms. This is because the frequency ramp is set to on. Press **RAMP ON(F5)** to change the ramp indication of frequency to .
- 3** Press **▲** or **▼** to move to another step and set the frequency of the step.
- 4** Press **ESC** to return to the previous screen.

■ Setting the step execution time

- 1** In a step to be edited, press **1/8 (F6) > TIME (F2)** for single-phase three-wire or three-phase output, or press **1/7 (F6) > TIME (F2)** for single-phase output to set the step execution time.
Set the step execution time with **HOURL(F3)**, **MIN(F4)**, **SEC(F5)**, and **100 US(F6)**. The minimum step execution time that you can set is 100 μ s. Do not set the step execution time to 0 s.
- 2** Press **▲** or **▼** to move to another step and set the step execution time of the step.
- 3** Press **ESC** to return to the previous screen.

■ Turning output on/off (Load on/ Load off)

Output is turned on by default.

- 1** In a step to be edited, press **1/8 (F6) > 2/8 (F6) > OUTPUT (F2)** for single-phase three-wire or three-phase output, or press **1/7 (F6) > 2/7 (F6) > OUTPUT (F2)** for single-phase output to turn output on/off.
- 2** Press **▲** or **▼** to move to another step and turn the output of the step on/off.
- 3** Press **ESC** to return to the previous screen.

■ Other settings

The sequence setting examples are shown with the default settings.

Set the following items if necessary.

Item	Default	Sequence setup screen page
DCI (DC current)	0.0 A, RAMP OFF	Page 3
TYPE (jump type)	NORM	Page 5
JUMP STEP (jump destination step)	0	Page 5
JUMP CNT (number of jump repetitions)	1	Page 5
WB NO (waveform bank number)	0	Page 2
STAT.OUT (status output)	OFF	Page 4
TRIG.OUT (trigger output)	OFF	Page 4
TRIG.IN (trigger input)	OFF	Page 4
S.PHASE (starting phase)	FREE	Page 6
E.PHASE (ending phase)	FREE	Page 6
PHAS.CHG (sudden phase change)	OFF	Page 6
CR (constant resistance function)	OFF	1P: page 7 1P3W and 3P: page 8
RESIST (CR resistance)	100.00 Ω	1P: page 7 1P3W and 3P: page 8

■ Sequence condition settings

1 Press COND (F4) to set the starting step number.

The default starting step number is 000. If START STEP is not 000, set it to 000.

2 Press ▼ to set the ending step number.

Set END STEP to a step number for the sequence end.

3 Press ESC to return to the previous screen.

NOTE

When you have finished setting the sequence, we recommend that you save the settings to a USB memory device.

1) Connect a USB memory device to the USB port on the front panel.

2) Press OTHERS (SHIFT+MEMORY) > 1/2 (F6) > FILE (F5) > SAVE (F3) > SEQ.

The name of the file that the sequence will be saved to is displayed in the entry area.

3) Press SAVE (F4) to save the settings.

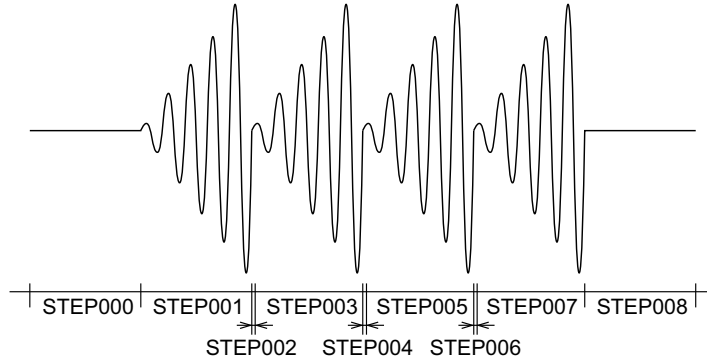
4) When the message "File was saved" disappears, remove the USB memory device from the USB port.

■ Sequence execution

See "Executing, Pausing, and Stopping Sequences" ([p. 148](#)).

Current sweep and frequency sweep

This section describes a sequence for outputting a continuous waveform that linearly changes from 0 A to 10 A.



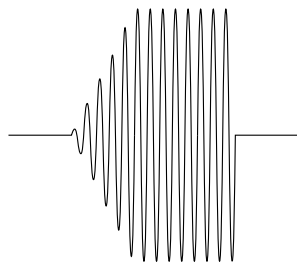
Step		000	001	002	003	004	005	006	007	008
ACI [A] AC current		0.0	10.0	0.0	10.0	0.0	10.0	0.0	10.0	0.0
RAMP (ACI) Current ramp		OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
FREQ [Hz] Frequency		50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
RAMP (FREQ) Frequency ramp		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TIME [ms] Step time		100	100	1	100	1	100	1	100	100
OUTPUT Output		ON	ON	ON	ON	ON	ON	ON	ON	ON

In a step with its ramp set to on, the current changes linearly from the current setting of the previous step to the specified current.

Because we want to change the current from 0 A to 10 A, the step before the step that will be set to 10 A must be set to 0 A. For this purpose, we will set short starting current steps before steps that will be set to 10 A. In this example, steps 002, 004, and 006 are the starting current steps. The minimum step execution time that you can set is 100 μ s. Do not set the step execution time to 0 s.

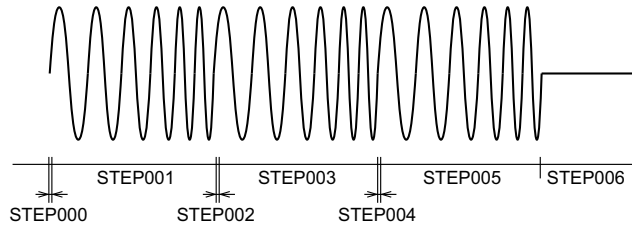
If you create a sequence without setting the starting current steps, the waveform shown below will be output. Because the current setting of step 002 is the same as the previous step (10 A), a ramp waveform will not be produced. Be careful.

For the details on how to set steps on the PCR-WEA series, see Sequence creation basics ([p. 150](#)).



Step		000	001	002	003
ACI [A] AC current		0.0	10.0	10.0	0.0
RAMP (ACI) Current ramp		OFF	ON	ON	OFF

Likewise, frequency sweeps also need starting frequency steps.



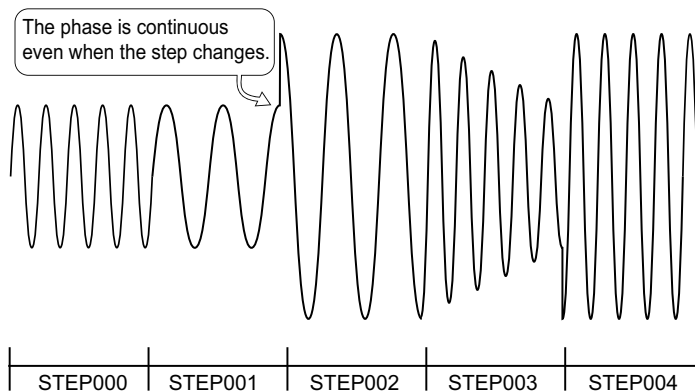
Step	000	001	002	003	004	005	006
ACI [A] AC current	0.0	10.0	10.0	10.0	10.0	10.0	0.0
RAMP (ACI) Current ramp	OFF	OFF	OFF	OFF	OFF	OFF	OFF
FREQ [Hz] Frequency	40.0	80.0	40.0	80.0	40.0	80.0	40.0
RAMP (FREQ) Frequency ramp	OFF	ON	OFF	ON	OFF	ON	OFF
TIME [ms] Step time	1	100	1	100	1	100	100
OUTPUT Output	ON	ON	ON	ON	ON	ON	ON

Here, steps 000, 002, and 004 are the starting frequency steps.

Switching steps at specific phase angles

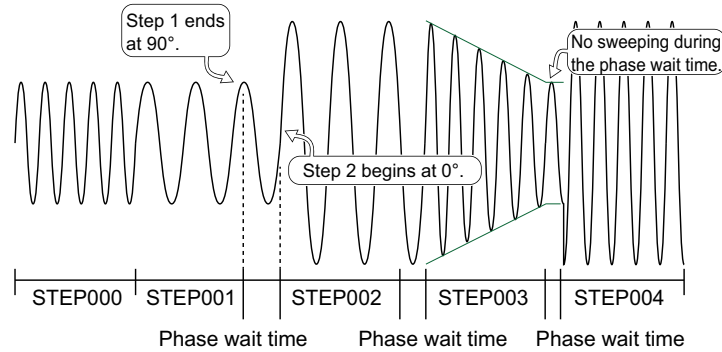
This section explains how to switch steps at specific phase angles to produce a continuous waveform.

Steps are managed in terms of time. If the starting phase angle and ending phase angle are set to FREE (default setting), the next step will start when the step time elapses. The phase still continues.



Step	000	001	002	003	004
ACI [A] AC current	5.0	5.0	10.0	5.0	10.0
RAMP (ACI) Current ramp	OFF	OFF	OFF	ON	OFF
FREQ [Hz] Frequency	50.0	25.0	25.0	50.0	50.0
TIME [ms] Step time	100	90	100	100	100
OUTPUT Output	ON	ON	ON	ON	ON
S.PHASE [deg]Starting phase angle	0	FREE	FREE	FREE	FREE

In this example, the phase angle of step 001 ends at 90° , so step 002 begins at 90° . Now, we change the starting phase angle so that steps 002 and 003 begin at 0° , and step 004 begins at 270° .



Step	000	001	002	003	004
ACI [A] AC current	5.0	5.0	10.0	5.0	10.0
RAMP (ACI) Current ramp	OFF	OFF	OFF	ON	OFF
FREQ [Hz] Frequency	50.0	25.0	25.0	50.0	50.0
TIME [ms] Step time	100	90	100	100	100
S.PHASE [deg] Starting phase angle	0	FREE	0	0	270

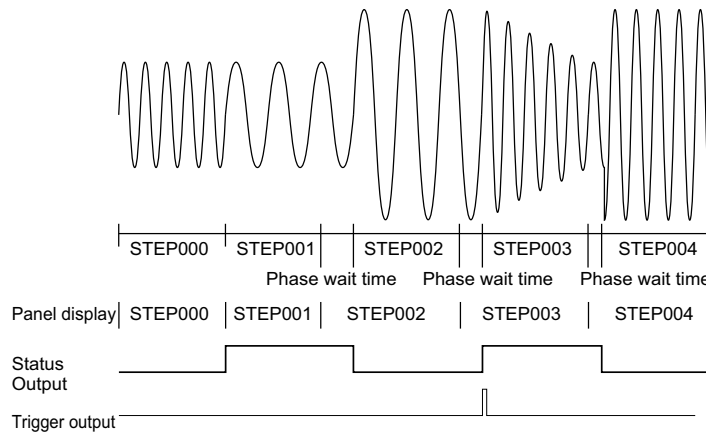
The phase angle of step 001 when its step time elapses is 90° . Because the starting phase angle of step 002 is 0° , the PCR-WEA waits until the phase angle of step 001 becomes 0° before executing step 002. This duration is the phase wait time. When the phase angle of step 001 reaches 0° , step 002 begins. The PCR-WEA does not sweep during the phase wait time.

If you set the starting phase angle, the time to run the entire sequence is extended by the phase wait time. The phase wait time depends on the specified frequency.

During the phase wait time, the panel shows the next step number.

The status signal is output while the waveform of the step with STAT.OUT set to ON is being output.

The trigger signal is produced when the step begins.

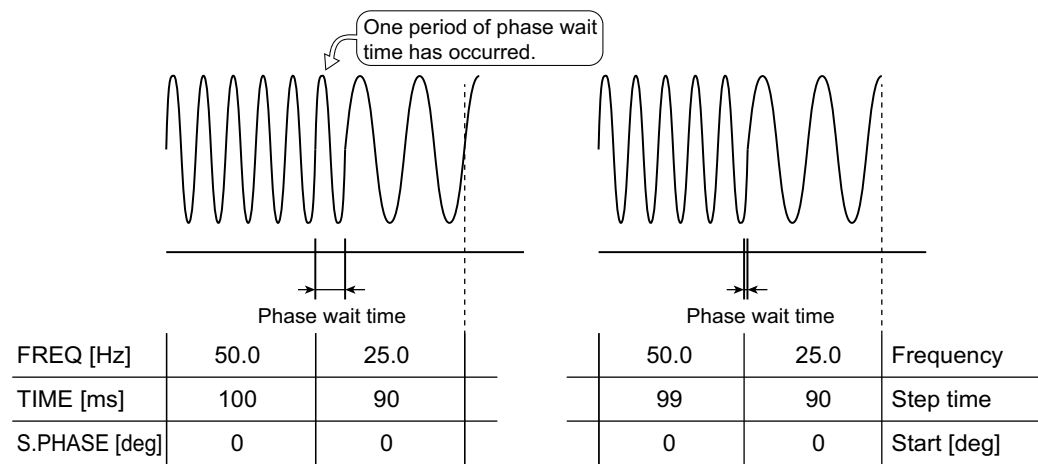


Step	000	001	002	003	004
FREQ [Hz] Frequency	50.0	25.0	25.0	50.0	50.0
S.PHASE [deg] Starting phase angle	0	FREE	0	0	270
STAT.OUT Status output	OFF	ON	OFF	ON	OFF
TRIG.OUT Trigger output	OFF	OFF	OFF	ON	OFF

You can also set the starting phase angle to FREE and the ending phase angle to a specific angle to product the same effect, but to avoid confusion, we recommend that you set the starting phase angle to a specific angle and the ending angle to FREE.

To output a waveform with continuous phase, be sure to set either the starting or ending phase angle to FREE. If you set both the starting and ending phase angles, the waveform may be offset by one period.

In this example, the starting phase angle of step 001 is FREE, so there is no phase wait time. Theoretically, there should not be any phase wait time if the starting phase angle is set to 0°, but depending on the conditions, the waveform may be offset by on period. If the time and phase angle are matched, we recommend that you use FREE. However, if you want to output an waveform accurately according to calculations, you need to shorten the previous step a little (1 ms in this example).

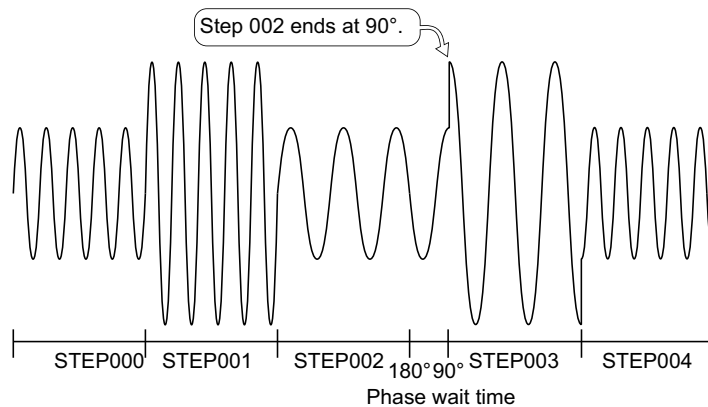


Suddenly changing the phase

To suddenly change the phase, specify a sudden phase change after setting the starting and ending phase angles.

This section explains an example of how to suddenly change the phase from 90° to 270° when the step changes from 002 to 003.

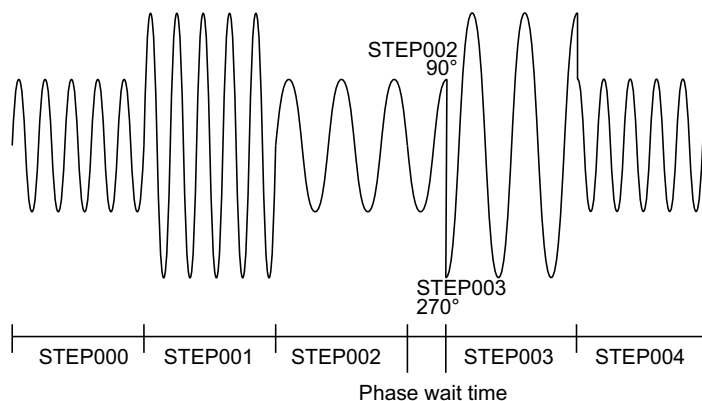
Because step 002 is set to 100 ms and 25 Hz, the phase angle will end at 180° if the ending phase angle is not specified (FREE). Because we want the phase to suddenly change from 90° to 270° between steps 002 and 003, we set the ending phase angle of step 002 to 90° . Step 003 will not begin until the phase angle changes from 180° to 90° , so there will be a phase wait time.



Step	000	001	002	003	004
ACI [A] AC current	5.0	10.0	5.0	10.0	5.0
FREQ [Hz] Frequency	50.0	50.0	25.0	25.0	50.0
TIME [ms] Step time	100	100	100	100	100
OUTPUT Output	ON	ON	ON	ON	ON
S.PHASE [deg] Starting phase angle	0	FREE	FREE	FREE	FREE
E.PHASE [deg] Ending phase angle	FREE	FREE	90	FREE	FREE
PHAS.CHG Sudden phase change	OFF	OFF	OFF	OFF	OFF

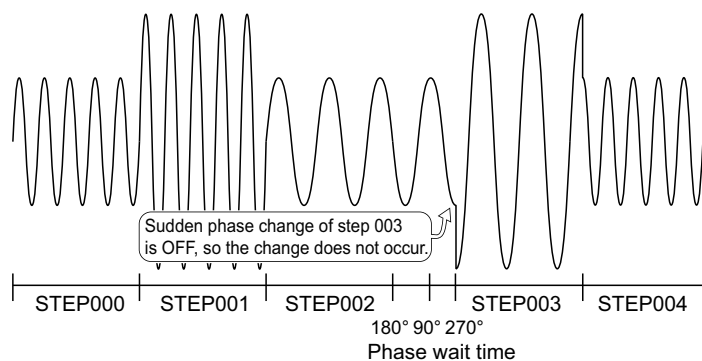
We want the phase to suddenly change to 270° in step 003, so we set the starting phase angle of step 003 to 270° and set the sudden phase change function to on. Step 002 will end at 90° , and step 003 will begin immediately from 270° .

To use sudden phase change, be sure to set the ending phase angle of the previous step and the starting phase angle of the step in which you want the phase to suddenly change. If you specify sudden phase change with either phase angle set to FREE, the phase will not change with the correct angles.



Step	000	001	002	003	004
ACI [A] AC current	5.0	10.0	5.0	10.0	5.0
FREQ [Hz] Frequency	50.0	50.0	25.0	25.0	50.0
TIME [ms] Step time	100	100	100	100	100
OUTPUT Output	ON	ON	ON	ON	ON
S.PHASE [deg] Starting phase angle	0	FREE	FREE	270	FREE
E.PHASE [deg] Ending phase angle	FREE	FREE	90	FREE	FREE
PHAS.CHG Sudden phase change	OFF	OFF	OFF	ON	OFF

Note that, even though you set both the starting and ending phase angles, the phase will not change suddenly unless you set the sudden phase change function to on. Be careful.



Step	000	001	002	003	004
S.PHASE [deg] Starting phase angle	0	FREE	FREE	270	FREE
E.PHASE [deg] Ending phase angle	FREE	FREE	90	FREE	FREE
PHAS.CHG Sudden phase change	OFF	OFF	OFF	OFF	OFF

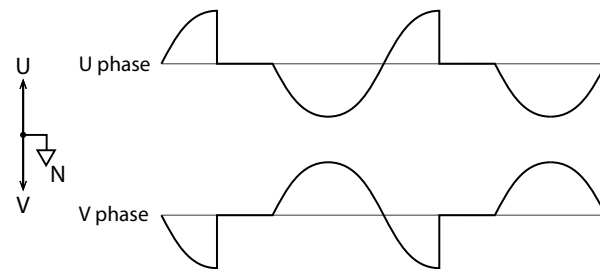
Single-phase three-wire output and three-phase output basics

Single-phase three-wire output or two-phase output

The figure below is an example of the output of a user-defined waveform whose U-V phase difference is 180° (factory default setting).

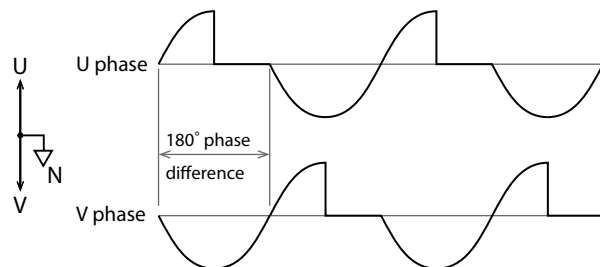
■ Single-phase three-wire output (2P Mode OFF) waveform

The phase setting is 180° , but the V-phase is not 180° out of phase with the U-phase. The V-phase is an inverted waveform of the U-phase.



■ Two-phase output (2P Mode ON) waveform

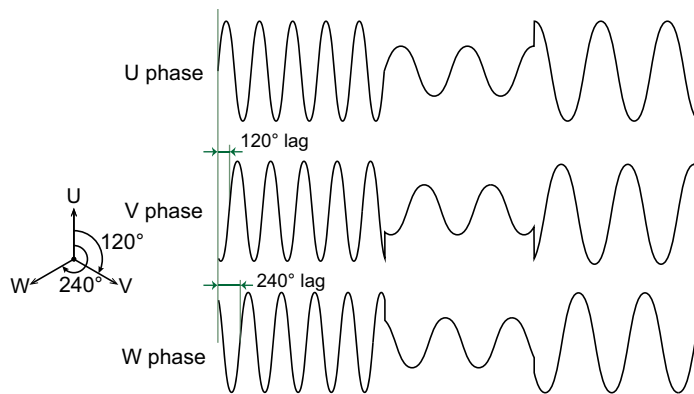
The waveform of the V-phase lags behind that of the U-phase by 180° . If you want to use two-phase such as in a V wiring connection, set 2P Mode to ON. You can set the U-V phase difference in the sequence step settings.



Three-phase output

The figure below shows the output of a three-step sequence where the U-V phase difference is 120° and the U-W phase difference is 240° (factory default setting).

The V phase lags the U-phase by 120° . The W phase lags the U-phase by 240° . You can set the U-V phase difference and the U-W phase difference in the sequence step settings.



Sudden phase change for multi-phase output

For details on the operation of starting and ending phase angles, see Switching steps at specific phase angles (p.154). For details on the operation of sudden phase changes, see Suddenly changing the phase (p.157).

NOTE

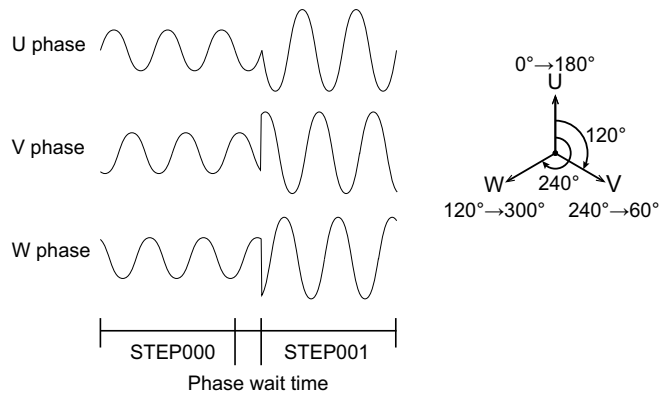
For the U-phase sudden phase change settings, set the starting phase, ending phase, and sudden phase change.

For the V-phase sudden-phase-change settings, set the U-V phase difference.

For the W-phase sudden-phase-change settings, set the U-W phase difference.

In the example below, the U-phase suddenly changes from 0° to 180° when step 001 begins.

Because the U-V and U-W phase differences in step 001 are set to OFF, the U-V phase difference remains at 120° and the U-W phase difference remains at 240° . When the U-phase is 0° , the V-phase lags by 120° , so specify 240° . The W phase lags by 240° , so specify 120° . The V-phase suddenly changes from 240° to 60° when step 001 begins. The W-phase suddenly changes from 120° to 300° .

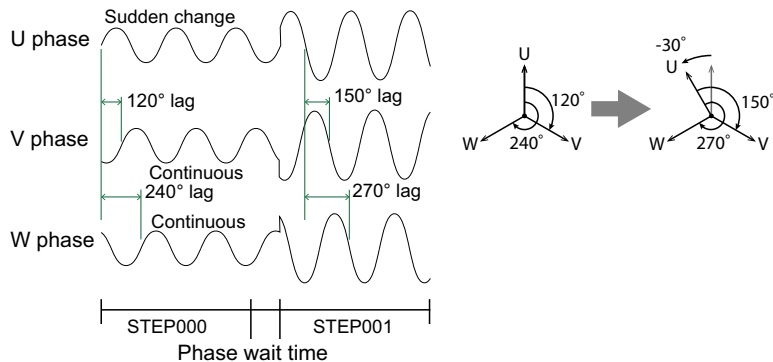


Step	000	001
S.PHASE [deg] Starting phase angle	FREE	180
E.PHASE [deg] Ending phase angle	0	FREE
PHAS. CNG sudden phase change	OFF	ON
U-V PHAS [deg] U-V phase difference	OFF	OFF
U-W PHAS [deg] U-W phase difference	OFF	OFF
U PHA.OFFS U phase offset	OFF	OFF

Suddenly changing only the U-phase

In the example below, the U-phase is suddenly changed from 0° to 30° when step 001 begins. The waveforms of the V and W phases are continuous.

When step 001 begins, the U-phase changes from 0° to 30° . If the U-V and U-W phase differences are set to OFF, the V-phase will suddenly change from 240° to 270° , and the W phase will suddenly change from 120° to 150° . Because we want only the U-phase to change suddenly, we add 30° to the phase differences (150° for the V-phase and 270° for the W-phase) so that the V and W phases will be continuous. When these settings are made, the waveforms of the V and W phases will be continuous.



Step	000	001
S.PHASE [deg] Starting phase angle	FREE	30
E.PHASE [deg] Ending phase angle	0	FREE
PHAS. CNG sudden phase change	OFF	ON
U-V PHAS [deg] U-V phase difference	OFF	150
U-W PHAS [deg] U-W phase difference	OFF	270
U PHA.OFFS U phase offset	OFF	OFF

You can also set the U-phase offset to cause the U-phase to suddenly change, but in this case, the U-V/ U-W phase difference settings will be offset from the actual phase difference. To avoid confusion, we recommend that you turn off the U-phase offset.

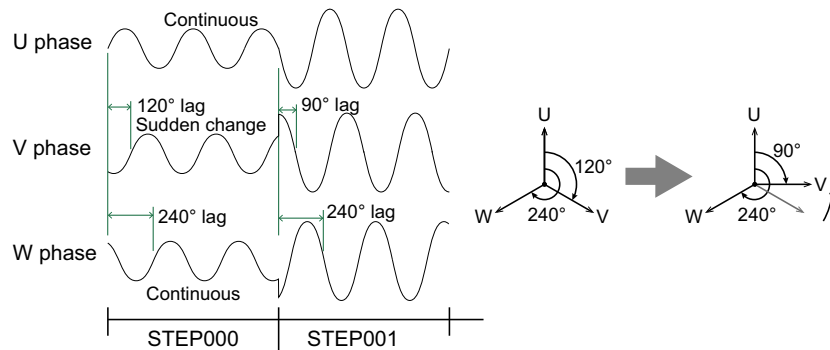
For details, see Phase sweep ([p.165](#)).

Suddenly changing the V-phase or W-phase

To suddenly change the V-phase, set the U-V phase difference. To suddenly change the W-phase, set the U-W phase difference.

In the example below, the U-V phase difference is suddenly changed from 120° to 90° when step 001 begins. The waveforms of the U and W phases are continuous.

Step 000 ends when the U-phase is 180° . When the U-phase is 180° in step 000, the V-phase is 60° , because the U-V phase difference is 120° . Because the U-V phase difference is changed to 90° in step 001, the V-phase starts at $180^\circ - 90^\circ = 90^\circ$. This means that only the V-phase suddenly changes from 60° to 90° when step 001 begins.

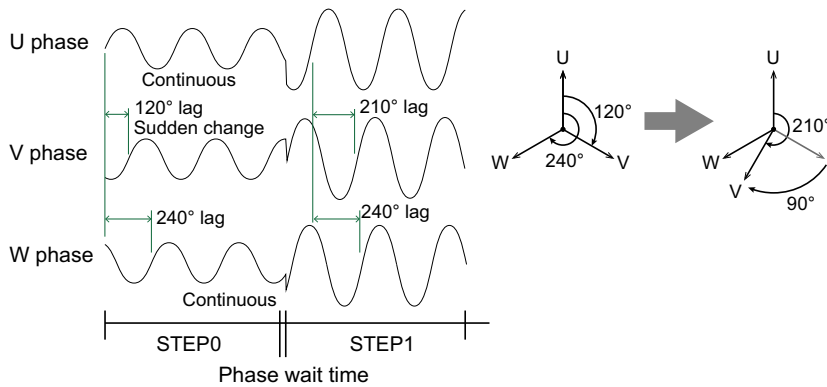


Step	0	1
S.PHASE [deg] Starting phase angle	FREE	FREE
E.PHASE [deg] Ending phase angle	FREE	FREE
PHAS. CNG sudden phase change	OFF	OFF
U-V PHAS [deg] U-V phase difference	OFF	90
U-W PHAS [deg] U-W phase difference	OFF	OFF
U PHA.OFFS U phase offset	OFF	OFF

The example below shows a sudden phase change in which step 001 begins at 0° when step 000 ends with the V-phase at 90°. The waveforms of the U and W phases are continuous.

Because the U-V phase difference is 120°, the V-phase is 90° when the U-phase is 210°. We want the V-phase to change at 90°, so we set the starting phase angle of step 001 to 210°. The U-phase angle is 210° when step 001 begins. To make the V-phase suddenly change to 0°, we set the U-V phase angle to 210°. The W-phase is continuous, so we leave the U-W phase difference at OFF.

When the U-phase angle of step 000 reaches 210°, step 001 begins. The V-phase suddenly changes from 90° to 0°.



Step	000	001
S.PHASE [deg]Starting phase angle	FREE	210
E.PHASE [deg]Ending phase angle	FREE	FREE
PHAS. CNG sudden phase change	OFF	OFF
U-V PHAS [deg] U-V phase difference	OFF	210
U-W PHAS [deg] U-W phase difference	OFF	OFF
U PHA.OFFS U phase offset	OFF	OFF

Phase sweep

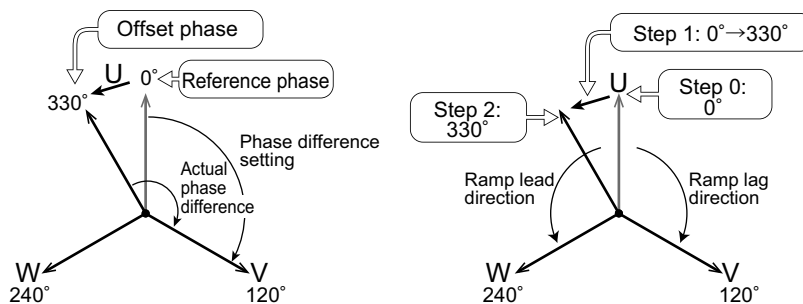
Sweeping the U-phase

To sweep the U-phase, you have to set the U-phase offset.

When a U-phase offset is specified, the U-V phase difference, U-W phase difference, starting phase angle, and ending phase angle settings are relative to the U-phase reference phase.

Setting a U-phase offset causes the U-V/U-W phase difference settings to be offset from the actual phase difference.

In the following example, U-phase is swept from 0° to 330° (leading) from step 001 to step 002. V and W phases will not be changed.



Specify the phase to sweep the U-phase with the U-phase offset.

Step	000	001	002
S.PHASE [deg] Starting phase angle	FREE	FREE	FREE
E.PHASE [deg] Ending phase angle	FREE	FREE	FREE
U PHA.OFFS [deg] U-phase offset	0	330	330
RAMP (U PHA.OFFS) U-phase ramp	OFF	LEAD	OFF
U-V PHAS [deg] U-V phase difference	OFF	OFF	OFF
RAMP (U-V PHAS) V-phase ramp	--	--	--
U-W PHAS [deg] U-W phase difference	OFF	OFF	OFF
RAMP (U-W PHAS) W-phase ramp	--	--	--
PHAS. CNG sudden phase change	OFF	OFF	OFF

Because we want to advance the phase from 0° to 330° in step 001, we set the U-phase offset of step 001 to 330°.

Phase sweep ramp can be set to leading (LEAD) or lagging (LAG).

Set the ramp of step 001 to LEAD. “-” is displayed for U PHASE OFFSET.

The U-V phase difference and U-W phase difference are the phase difference from the U-phase reference phase. Because we are not changing the V-phase and W-phase, we leave their settings at off (U-V phase difference: 120°, U-W phase difference: 240°).

The U-V phase difference and U-W phase difference are phase differences from the U-phase reference phase, so if we set an offset for the U-phase in step 001, even if the U-V phase difference setting is 120°, the actual phase difference will be 150° (120° + 30°), which means that the phase difference setting will be offset from the actual phase difference. Likewise, the U-W phase difference setting will be offset from the actual phase difference.

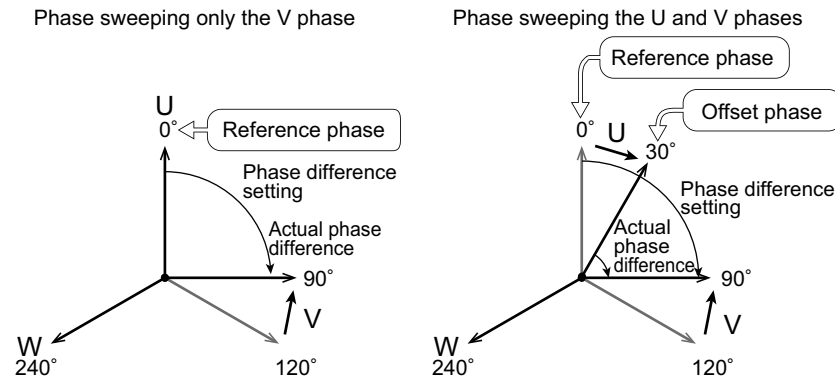
The output state when the sequence is complete is the state specified in the last step. If the sequence ends with a U-phase offset, as in this example, the U PH OFS icon will appear.

If the icon is displayed, press SEQ (SHIFT+SIM) > 1/2 > U PHASE to clear the offset.

Sweeping the V-phase and W-phase

Specify the phase to sweep the V-phase with the U-V phase difference. Specify the phase to sweep the W-phase with the U-W phase difference.

Below is an example of sweeping the V-phase and an example of sweeping the U and W phases.



Phase sweeping only the V-phase

Step	000	001	002
S.PHASE [deg] Starting phase angle	FREE	FREE	FREE
E.PHASE [deg] Ending phase angle	FREE	FREE	FREE
U PHA.OFFS [deg] U-phase offset	OFF	OFF	OFF
RAMP (U PHA.OFFS) U-phase ramp	OFF	OFF	OFF
U-V PHAS [deg] U-V phase difference	120	90	OFF
RAMP (U-V PHAS) V-phase ramp	OFF	LEAD	OFF
U-W PHAS [deg] U-W phase difference	OFF	OFF	OFF
RAMP (U-W PHAS) W-phase ramp	--	--	--
PHAS. CNG sudden phase change	OFF	OFF	OFF

Phase sweeping the U and V phases

To sweep the U and V phases, you have to set the U-phase offset. In step 001, to sweep the U-phase from 0° to 30° and the V-phase from 120° to 90°, even though the actual U-V phase difference is 60°, set the U-V phase difference to 90° because this value must be set relative to the U-phase reference phase when a U-phase offset is set. The U-V phase difference setting is offset from the actual phase difference.

Step		000	001	002
S.PHASE [deg]	Starting phase angle	FREE	FREE	FREE
E.PHASE [deg]	Ending phase angle	FREE	FREE	FREE
U PHA.OFFS [deg]	U-phase offset	0	30	30
RAMP (U PHA.OFFS)	U-phase ramp	OFF	LAG	OFF
U-V PHAS [deg]	U-V phase difference	120	90	90
RAMP (U-V PHAS)	V-phase ramp	OFF	LEAD	OFF
U-W PHAS [deg]	U-W phase difference	OFF	OFF	OFF
RAMP (U-W PHAS)	W-phase ramp	--	--	--
PHAS. CNG	sudden phase change	OFF	OFF	OFF

External Control

The PCR-WEA series can be controlled and monitored from an external device.

Control	Functions that can be controlled/ monitored	Connector
Analog control	Amplify the input waveform	ANALOG IN
	Change the current or frequency	
	Monitor the rms voltage or current (factory option)	ANALOG OUT
Digital control	Control through external contacts	DIGITAL I/O
	Monitor operating status	

External control connectors

If you want to amplify the input waveform or change the current or frequency using analog signals, use the ANALOG IN connector. If you want to monitor the rms voltage or current, use the ANALOG OUT connector (factory option).

If you want to use the ANALOG IN or ANALOG OUT connector, use the optional analog control connector (OP02-PCR-WE).

If you want to perform digital control, use the DIGITAL I/O connector.

If you want to use the DIGITAL I/O connector, use the included external control (DIGITAL I/O) connector.

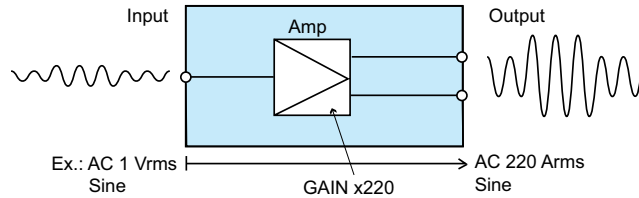
For details on how to use the connectors, see the Hirose Electric catalog.

	ANALOG IN connector ANALOG OUT connector (OP02-PCR-WE)	DIGITAL I/O connector	Notes
Plug model	HDEB-9P (05)	HDBB-25P (05)	By Hirose Electric
Plug case	HDE-CTH (4-40) (10)	HDB-CTH (4-40) (10)	
Wire diameter	AWG28 to AWG20		Soldering (≤ 40 W, ≤ 4 seconds)

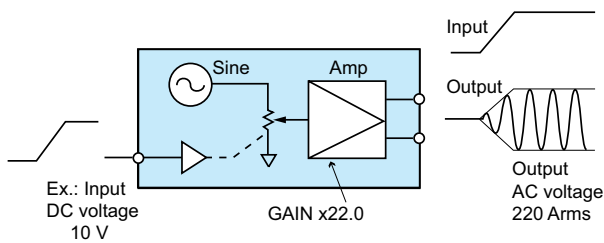
Control Using Analog Signals

External analog signals can be used to perform the following controls.

■ Amplifies the input waveform



■ Change the AC current, DC current, or frequency using a DC signal

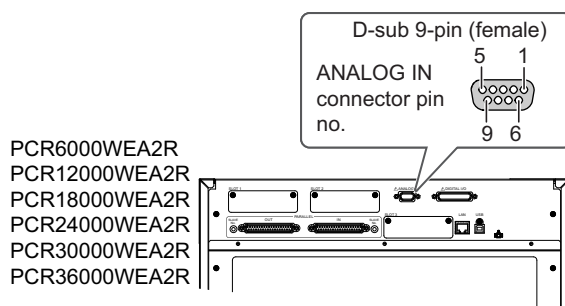


ANALOG IN connector pin arrangement

WARNING

Risk of electric shock.

Use the ANALOG IN connector, ANALOG OUT connector, and DIGITAL I/O connector with an isolation voltage of 42 V_{peak} or less.

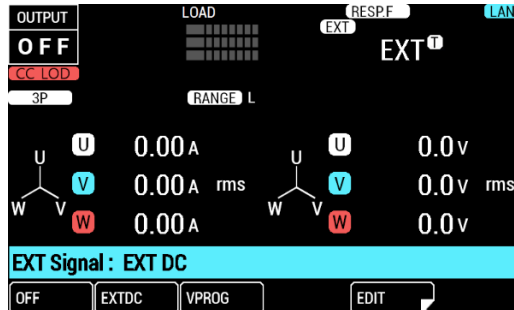


Terminal No.	Terminal name
1	Ch. A
2	Ch. B
3	Ch. C
4	--
5	--
6	COM of Ch. A ¹
7	COM of Ch. B ¹
8	COM of Ch. C ¹
9	--

1. The common lines of the analog input signals, analog output signals, digital input signals, and selectable input signals are not isolated.

Selecting the parameter to control

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) to set the parameter to control with the external analog signal.



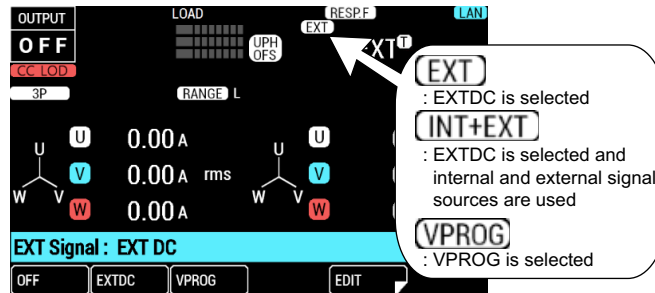
Item	Title	Description
OFF (F1)	EXT Signal	Disables the use of the external analog signal
EXTDC (F2)		Amplifies the input waveform
VPROG (F3)		Changes the current or frequency value

- 2 Press APPLY(F4) to confirm the settings.

Press CANCEL(F5) to cancel the settings.

- 3 Confirm the icon shown on the display.

- EXT: Select EXTDC and use external signal source only.
- INT+EXT: Select EXTDC and use internal signal source and external signal source.
- VPROG: Select VPROG.



This completes the setting.

Amplifying the input waveform (EXTDC mode)

You can use the PCR-WEA series as a power amplifier that simply amplifies the input waveform or use it to add an external signal to the PCR-WEA signal source.

For single-phase output and single-phase three-wire output, Ch. A is used. Ch. B and Ch. C are disabled.

For three-phase output, Ch. A to Ch. C are used.

Ch. A: U-phase control

Ch. B: V-phase control

Ch. C: W-phase control

Select "EXTDC" for the parameter to control with the external signal. After selecting, set the signal source, polarity, and measurement time.

Selecting the signal source

Select which signal source to use to control the PCR-WEA series.

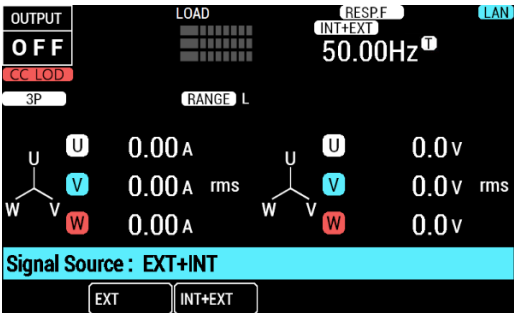
Internal signal source and external signal source (INT+EXT)

An external signal source is added to the PCR-WEA's internal signal source.

External signal source (EXT)

Converts external signals(0 Vpk to 10 Vpk) to current and amplifies them.

- Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > EXTDC (F2) > SOURCE (F1) to set the signal source.



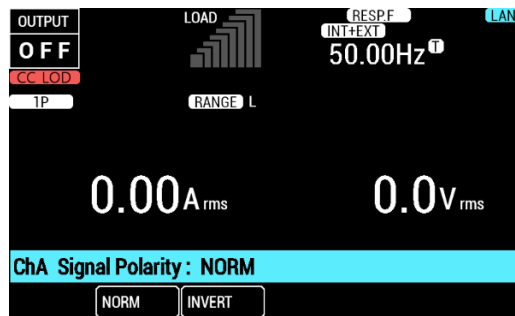
Item	Title	Description
EXT (F2)	Signal Source	Uses an external signal
INT+EXT (F3)		Uses the internal signal and an external signal

Selecting the polarity

Select whether to output a signal whose polarity is the same as or opposite to that of the input signal.

■ Single-phase connection and single-phase three-wire connection

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > EXTDC (F2) > POL (F2) > CH A (F1) to set the polarity.

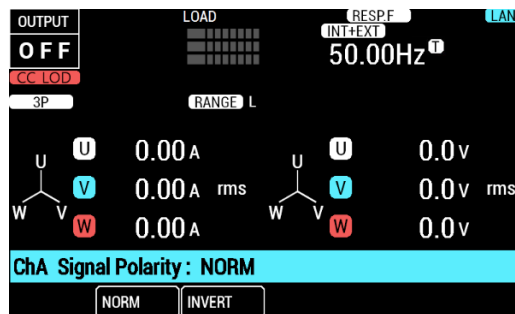


Item	Title	Description
NORM (F2)	ChA Signal Polarity	Output a signal whose polarity is the same as the input signal.
INVERT (F3)		Outputs a signal whose polarity is opposite to that of the input signal.

■ Three-phase connection

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > EXTDC (F2) > POL (F2), select the phase you want to set (CH A, CH B, CH C), and then set the polarity.

CH A (F1) is the U-phase, CH B (F2) the V-phase, and CH C (F3) the W-phase.



Item	Title	Description
NORM (F2)	Ch A/B/C Signal	Output a signal whose polarity is the same as the input signal.
INVERT (F3)	Polarity	Outputs a signal whose polarity is opposite to that of the input signal.

Setting the measurement time

If the measurement time is not set, the voltage and current that are being output may be different from what are displayed on the panel.

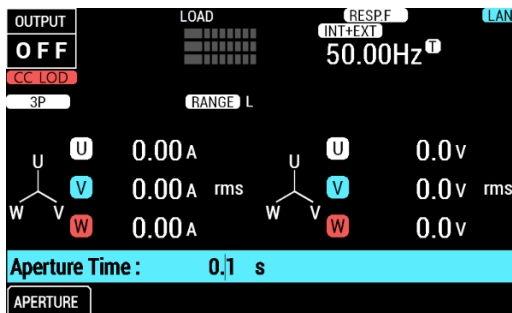
With a longer measurement time, the measurements become more stable, but it takes longer to update the display of the measured values. Guidelines for the measurement time when the signal includes an AC component are given below.

- When the period of the AC is known, you can obtain the most accurate measurement results if you set the measurement time to an integer multiple of the period.

Example: If the repetition interval of the AC component is 0.1 s, you can obtain the best results in the shortest time if you set the measurement time to 0.1 s.

- When the repetition interval of the AC component is unknown, you can obtain comparatively stable measurement results if you set the measurement time to a value that is at least 10 times the expected period.

- Press **OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > EXTDC (F2) > APERTURE (F3)** to set the measurement time.



Item	Title	Description
APERTURE (F3)	Aperture Time	Sets the measurement time (0.1 s to 1.0 s, resolution: 0.1 s).

Outputting

After you set the signal source, polarity, and measurement time, apply an external signal to the ANALOG IN connector.

- Turn the **POWER** switch off.
- Connect an external signal (generator) to the **ANALOG IN** connector.
- Turn the **POWER** switch on.
- Press **RANGE (SHIFT+8)** to set the voltage range (L/H).
- Apply the external signal to the **ANALOG IN** connector.
- Turn the output on.

Adjusting the offset

You can adjust the offset. With the ANALOG IN connector shorted, adjust the offset so that the output voltage is as close to 0 Vdc as possible.

■ for single-phase connection

- 1 Press OTHERS SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > EXTDC (F2) > USR ADJ (F4) > CH A (F1) > OFFSET (F2) to set the offset.

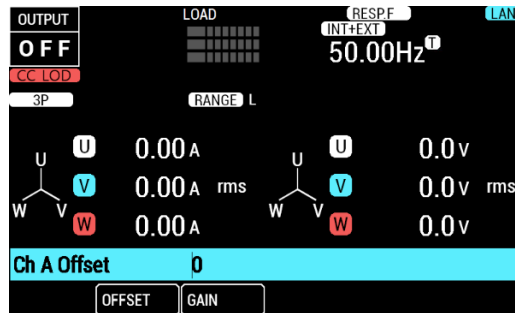


Item	Title	Description
OFFSET (F2)	ChA Offset	Sets the offset (-200 to 200, resolution: 1).

■ Single-phase three-wire connection, Three-phase connection

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > EXTDC (F2) > USR ADJ (F4), and then press the phase to be set (CH A/CH B/CH C) > OFFSET (F2) to set the offset.

CH A (F1) is the U-phase, CH B (F2) the V-phase, and CH C (F3) the W-phase.



Item	Title	Description
OFFSET (F2)	Ch A/B/C Offset	Sets the offset (-200 to 200, resolution: 1).

Adjusting the gain

You can set the gain magnification.

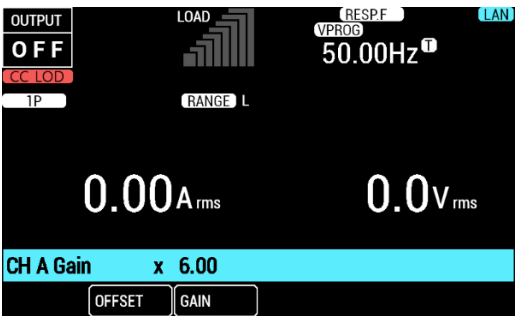
The setting range varies depending on the model and connection method. For details, see “Gain setting range” (p.221).

■ for single-phase connection

NOTE

- If there are power modules that are paused by the power module management function, the gain setting range is changed according to the number of power modules (power capacity) that are running.
- When the power module management setting is changed, the gain values are reset to factory default settings.

- 1** Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT(F1) > EDIT (F5) > EXTDC (F2) > USR ADJ (F4) > CH A (F1) > GAIN (F3) to set the gain.

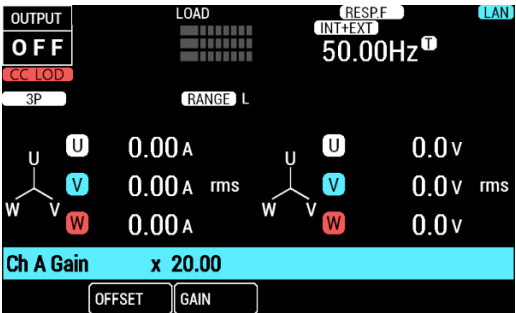


Item	Title	Description
GAIN (F3)	ChA Gain	Sets the gain (resolution: x0.01).

■ Single-phase three-wire connection, Three-phase connection

- 1** Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > EXTDC (F2) > USR ADJ (F4), and then press the phase to be set (CH A/CH B/CH C) > GAIN (F3) to set the gain.

CH A (F1) is the U-phase, CH B (F2) the V-phase, and CH C (F3) the W-phase.



Item	Title	Description
GAIN (F3)	Ch A/B/C Gain	Sets the gain (resolution: x0.01).

Limit function

If you use an external signal, you will not be able to use the following functions, in addition to the settings that were changed when you selected the signal source.

■ When the internal signal source and an external signal source (INT+EXT) are in use

- Harmonic current analysis function
- Soft start and soft stop

■ When an external signal source (EXT) is in use

- Setting the output voltage or voltage limits
- Setting the frequency or frequency limits
- Memory usage
- Generating special waveforms
- Harmonic current analysis function
- Sequence function
- Phase difference (only for single-phase three-wire output and three-phase output)
- Soft start and soft stop

Change the current or frequency using a DC signal (VPROG mode)

The following parameters can be varied using DC signals.

■ **Current**

Outputs current in response to the external DC signal (0 Vdc to 10 Vdc) input.

■ **Frequency**

Outputs 45 Hz to 65 Hz in response to the external DC signal (0 Vdc to 10 Vdc) input.

Select “VPROG” (p.171) for the parameter to control with the external signal. After selecting, set the controlled parameter.

Selecting the controlled parameter for single-phase connection and single-phase three-wire connection

Set the channel to control using external analog signals.

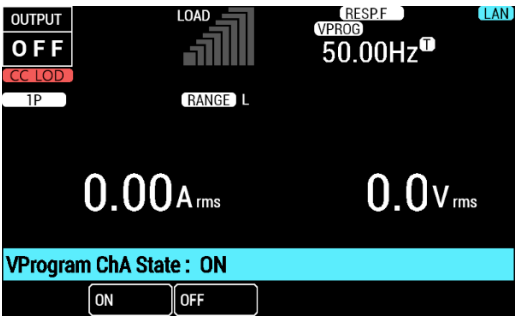
■ **Channel configuration**

Ch. A: AC current control

Ch. B: DC current control

Ch. C: AC frequency control

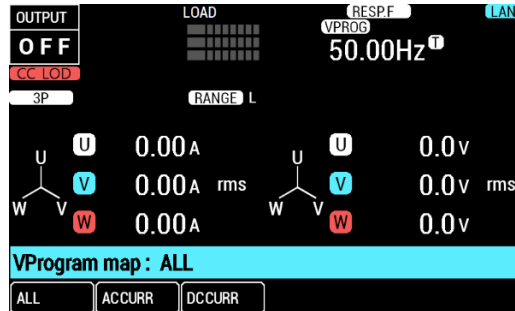
- 1** Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > VPROG (F3) > STATE (F2), select the channel you want to set (CH A, CH B, CH C), and then set whether to control it.



Item	Title	Description
ON (F2)	VProgram Ch A/B/C State	Enables control
OFF (F3)		Disables control

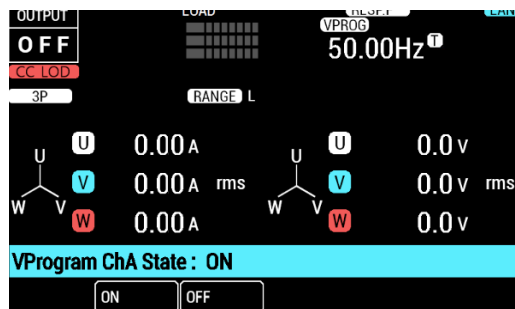
Selecting the controlled parameter for three-phase output

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > VPROG (F3) > MAP (F1) to select the channel configuration.



Item	Title	Description
ALL (F1)	VProgram map	Ch A: AC current, Ch B: DC current, Ch C: frequency
ACCURR (F2)		Ch A: AC current of U-phase, Ch B: AC current of V-phase, Ch C: AC current of W-phase
DCCURR (F3)		Ch A: DC current of U-phase, Ch B: DC current of V-phase, Ch C: DC current of W-phase

- 2 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > VPROG (F3) > STATE (F2), select the channel you want to set (CH A, CH B, CH C), and then set whether to control it.



Item	Title	Description
ON (F2)	VProgram Ch A/B/C State	Enables control
OFF (F3)		Disables control

Outputting

After you set the signal source, apply an external signal to the ANALOG IN connector.

- 1** Turn the POWER switch off.
- 2** Connect an external signal (generator) to the ANALOG IN connector.
- 3** Turn the POWER switch on.
- 4** Press RANGE (SHIFT+8) to set the voltage range (L/H).
- 5** Press F > FREQ (F1) to set the frequency (1.0 Hz to 5000 Hz).
- 6** Apply the external signal to the ANALOG IN connector.
- 7** Turn the output on.

Finely adjusting the offset and gain

You can finely adjust the current offset and gain. This is not applied to the frequency.

- 1** Short the ANALOG IN connector.
- 2** Turn the output on.
- 3** Adjust the offset ([p.181](#)) so that the current is as close to 0 Adc as possible.
- 4** Apply 10 Vdc to the ANALOG IN connector.
- 5** Adjust the gain ([p.182](#)) so that the output current reaches a desired current.
- 6** Apply 1 VDC to the ANALOG IN connector to check that the output current is 1/10 of the desired current.

If it is not, repeat steps 1 to 5 until the output current is 1/10 of the desired current.

When you adjust either the offset or the gain, the other value that you adjusted before may shift. Be sure to check it.

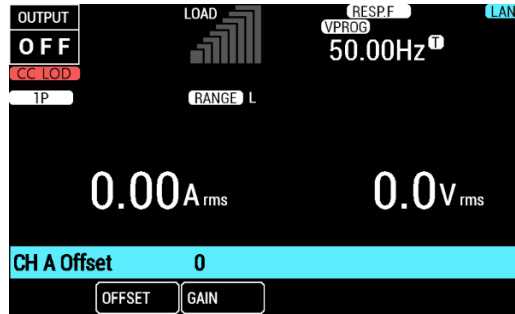
- 7** Turns off the output.

Adjusting the offset

You can adjust the offset. With the ANALOG IN connector shorted, adjust the offset so that the output current is as close to 0 Adc as possible.

■ for single-phase connection

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > VPROG (F3) > USR ADJ (F4) > CH A (F1) > OFFSET (F2) to set the offset.

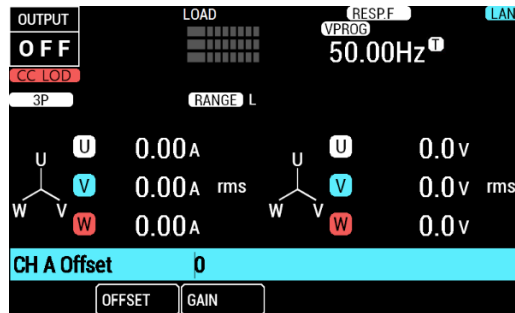


Item	Title	Description
OFFSET (F2)	ChA Offset	Sets the offset (-200 to 200, resolution: 1).

■ Single-phase three-wire connection, Three-phase connection

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > VPROG (F3) > USR ADJ (F4), and then press the phase to be set (CH A/CH B/CH C) > OFFSET (F2) to set the offset.

CH A (F1) is the U-phase, CH B (F2) the V-phase, and CH C (F3) the W-phase.



Item	Title	Description
OFFSET (F2)	Ch A/B/C Offset	Sets the offset (-200 to 200, resolution: 1).

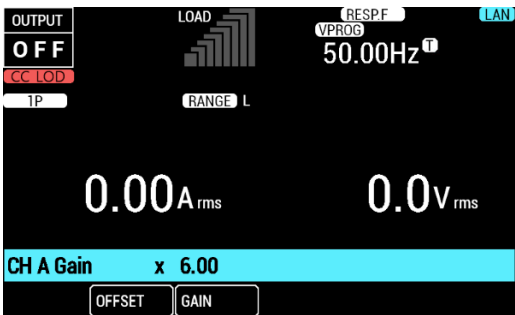
Adjusting the gain

You can set the gain magnification.

The setting range varies depending on the model and connection method. For details, see “Gain setting range” (p.221).

■ for single-phase connection

- 1** Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > VPROG (F3) > USR ADJ (F4) > CH A (F1) > GAIN (F3) to set the gain.

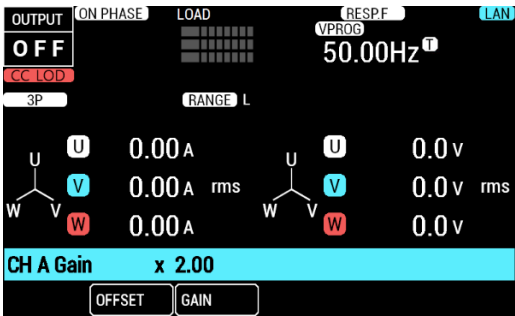


Item	Title	Description
GAIN (F3)	ChA Gain	Sets the gain (resolution: x0.01).

■ Single-phase three-wire connection, Three-phase connection

- 1** Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > INPUT (F1) > EDIT (F5) > VPROG (F3) > USR ADJ (F4), and then press the phase to be set (CH A/CH B/CH C) > GAIN (F3) to set the gain.

CH A (F1) is the U-phase, CH B (F2) the V-phase, and CH C (F3) the W-phase.



Item	Title	Description
GAIN (F3)	Ch A/B/C Gain	Sets the gain (resolution: x0.01).

Limit function

If an external signal is used, you will not be able to use the following functions.

- Soft start
- Sequence function
- Harmonic current analysis function

Control Using Digital Signals

External digital signals can be used to perform the following controls.

- Controlling through external contacts
- Monitoring the operation status

DIGITAL I/O connector pin arrangement and mapping

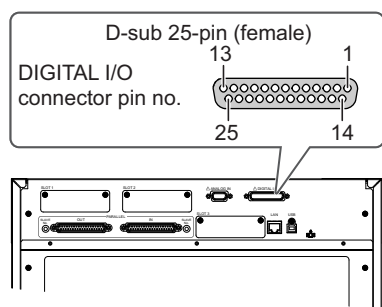
WARNING

Risk of electric shock.

Use the ANALOG IN connector, ANALOG OUT connector, and DIGITAL I/O connector with an isolation voltage of 42 V_{peak} or less.

There are four channels (CTRL.1 to CTRL.4) that are controlled through external contacts, four channels (STAT.1 to STAT.4) that monitor the operating status, and two channels (DIO.1, DIO.2) that you can select whether to control through external contacts or monitor the operating status (selectable I/O).

These channels are accessible through the DIGITAL I/O connector.



Terminal No.	Input or output	Terminal name
1	IN	CTRL.1
2	IN	CTRL.2
3	IN	CTRL.3
4	IN	CTRL.4
5	--	--
6	OUT	STAT.1
7	OUT	STAT.2
8	OUT	STAT.3
9	OUT	STAT.4
10	--	--
11	IN/OUT	DIO.1
12	IN/OUT	DIO.2
13	--	--
14	--	COM of CTRL.1, CTRL.2, CTRL.3, CTRL.4, DIO.1, DIO.2 ¹
15		
16		
17		
18	--	--

Terminal No.	Input or output	Terminal name
19	OUT	STAT.1 COM
20	OUT	STAT.2 COM
21	OUT	STAT.3 COM
22	OUT	STAT.4 COM
23	--	--
24	--	COM ¹
25		

1. The common lines of the analog input signals, analog output signals, digital input signals, and selectable input signals are not isolated.

Signals that can be mapped to the pins

The signals to be controlled can be mapped to the channels of the DIGITAL I/O connector. The following table shows the signals that can be mapped. CTRL.4 and STAT.4 cannot be mapped.

For details, see Controlling through external contacts ([p. 186](#)), Monitoring the operation status ([p. 190](#)), "Selectable I/O" ([p. 193](#)).

When using external contacts for control and the selectable I/O as input, the same control signal cannot be assigned to multiple channels (CTRL.1 to CTRL.4, DIO.1, DIO.2).

When the operating status is monitored with the selectable I/O as output, the same control signal can be assigned to multiple channels (STAT.1 to STAT.4, DIO.1, DIO.2).

Control signal	Input or output	CTRL.1 to CTRL.3	CTRL.4	STAT.1 to STAT.3	STAT.4	DIO.1 DIO.2
Output on/off	IN					✓
Sequence run/stop	IN	✓				✓
Alarm Clear	IN	✓				✓
External alarm input	IN	✓				✓
Output method change (single-phase)	IN	✓				✓
Output method change (single-phase three-wire)	IN	✓				✓
Output method change (three-phase)	IN	✓				✓
Output range switching	IN	✓				✓
Preset memory A recall	IN	✓				✓
Preset memory B recall	IN	✓				✓
Preset memory C recall	IN	✓				✓
Output ON inhibit	IN	✓				✓
Programmable signal in	IN	✓				✓
Shutdown	IN		✓			
Output reference phase input	IN					✓
Sequence trigger input	IN					✓
Output ON status	OUT			✓		✓
CC Load mode/CC Supply mode setting status	OUT			✓		✓
Overload status	OUT			✓		✓
Busy status	OUT			✓		✓
Output method status (single-phase)	OUT			✓		✓
Output method status (single-phase three-wire)	OUT			✓		✓
Output method status (three-phase)	OUT			✓		✓

Control signal	Input or output	CTRL.1 to CTRL.3	CTRL.4	STAT.1 to STAT.3	STAT.4	DIO.1 to DIO.2
Output voltage H range status	OUT			✓		✓
POWER switch on status	OUT			✓		✓
Sequence status output	OUT			✓		✓
Programmable signal status	OUT			✓		✓
Alarm status	OUT				✓	
Output reference phase output	OUT					✓
Sequence trigger output	OUT					✓

Controlling through external contacts using CTRL channels

To reduce the influence of noise on the output, connect a 2-core shielded wire or a twisted-pair wire, and keep the wire as short as possible. If the wiring is long, it becomes easy for noise to influence the operation of the PCR-WEA. Even if you use cables that are designed to suppress noise, the PCR-WEA may not operate properly.

The maximum open-circuit voltage across input pins is approximately 12 V, and the maximum short-circuit current is approximately 7.1 mA (the internal circuits are pulled up to 12 V with 1.7 kΩ resistors).

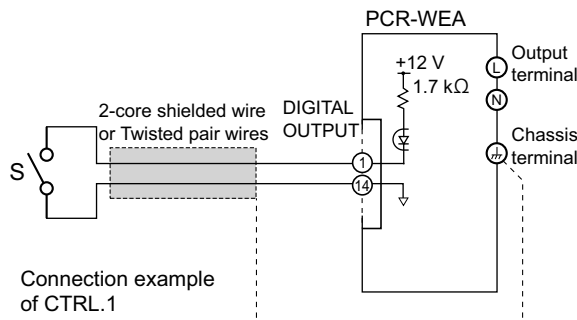
Use external contacts that have a contact rating greater than or equal to 7.1 mA at 12 Vdc.

High-level input voltage: 11 V to 12 V, or open

Low-level input voltage: 0 V to 1 V

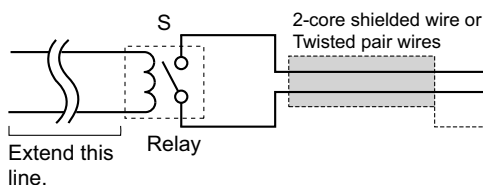
You can set the active signal polarity for each channel.

If you are using a shielded cable, connect the shield to the connector shell.



■ For long-distance wiring

When you are wiring over a great distance, use a small relay and extend the coil side of the relay.



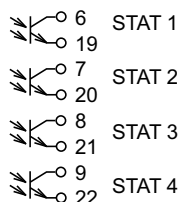
Monitoring the operating status using STAT channels

The output signal is an open-collector output from a photocoupler (30 Vdc, 8 mAmax). It is isolated from the inside of the product.

You can set the active signal polarity for each channel.

Maximum voltage: 30 V

Maximum current (sink): 8 mA



Controlling through external contacts

There are four channels (CTRL.1 to CTRL.4) that can be controlled through external contacts.

You can select (map) control signals for CTRL.1 to CTRL.3. CTRL.4 is fixed to shutdown signal.

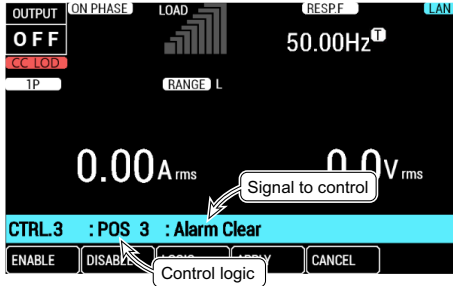
There are two additional channels (DIO.1, DIO.2) that you can select whether to control through external contacts or monitor the operating status ([p.193](#)).

The same control signal cannot be assigned to multiple channels (CTRL.1 to CTRL.4, DIO.1, DIO.2).

Signals controllable through external contacts		
Output on/off	Output Control	
Sequence run/stop	SEQ Execution Control	
Alarm Clear	Alarm Clear	
External alarm input	External Alarm	
Output method change (single-phase)	Wiring Control 1P	
Output method change (single-phase three-wire)	Wiring Control 1P3W	
Output method change (three-phase)	Wiring Control 3P	
Output range switching	Volt Range	
Preset memory A recall	Recall A Memory	
Preset memory B recall	Recall B Memory	
Preset memory C recall	Recall C Memory	
Output-on inhibit	Output Inhibit	
Programmable signal in	Programmable Signal	
Shutdown	Shut Down	Fixed to CTRL.4.

The output reference phase input and the sequence trigger input can be controlled by setting to "Selectable I/O" ([p.193](#)).

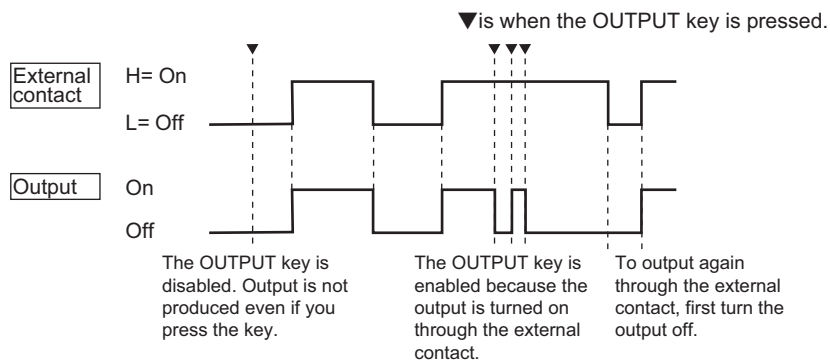
Set control signals

- 1 Press **CONFIG** (SHIFT+OPR MODE) > **EXT.DIO** (F2) > **CTRL.IN** (F1).
- 2 Select a channel to be set (**CTRL.1** (F1)/**CTRL.2** (F2)/**CTRL.3** (F3)).
CTRL.4 is fixed (shutdown). You cannot set this value.
- 3 Press **ENABLE** (F1) to enable external contact control on the assigned channel.
If you want to disable it, press **DISABLE** (F2).
- 4 Use the rotary knob to select the signal to control with an external contact.

- 5 Press **LOGIC** (F3) to select the control logic.
To set logical true to HIGH, select **POS** (F3). To set logical true to LOW, select **NEG** (F4).
- 6 Press **ESC**.
- 7 Press **APPLY**(F4).
To cancel, press **CANCEL** (F5).
This completes the setting.

■ Turning output on and off (Output Control)

If two or more units are floating, and you are using a single external contact to turn output on and off for all the units, use a relay or similar device for the external contact signal to isolate the signal transmitted to each unit.

The figure below shows an example of output on/off control when a high level signal turns the output on.



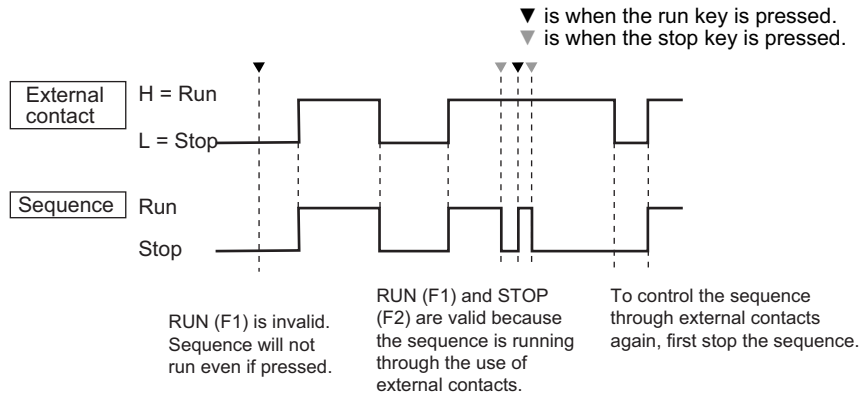
When a sequence is running or when soft start/ soft stop is set to on, the output on/off control through external contacts is invalid.

■ Running and stopping a sequence (SEQ Execution Control)

Sequence execution can be controlled through external contacts.

When a sequence is stopped through external contacts, RUN (F1) on the front panel is invalid. If you do not want to control the sequence through external contacts, select DISABLE.

The following figure shows an example of sequence execution control when a high level signal is used to run the sequence.



■ Clearing alarms (Alarm Clear)

Alarms can be cleared through external contacts.

■ External alarm input (External Alarm)

Alarms can be generated through external contacts. "ALM-19 EXT ALARM" is displayed, and the output turns off.

■ Changing the output method (Wiring Control)

The output method can be changed through external contacts.

■ Switching the output range (Volt Range)

The output voltage/current range can be changed through external contacts.

Logical true sets the output voltage/current range to H range.

■ Recalling settings from preset memory (Recall)

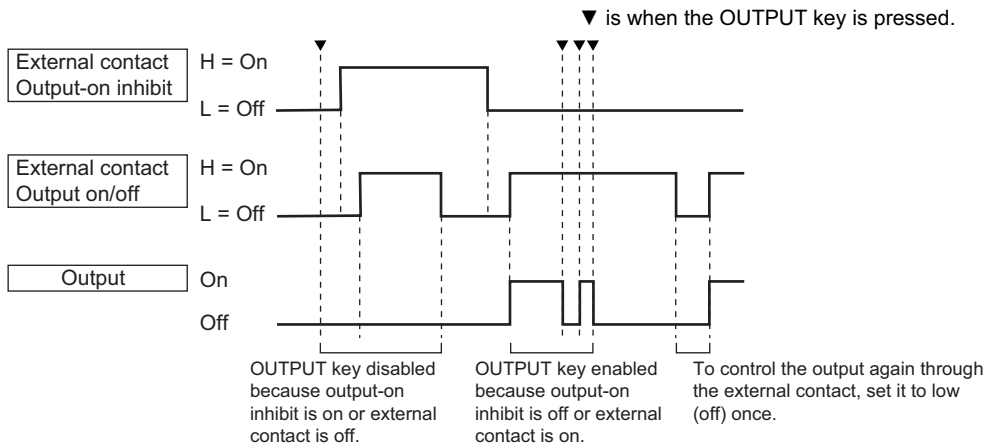
Settings can be recalled from preset memory through external contacts.

■ Inhibiting the output from being turned on (Output Inhibit)

The output-on inhibit function can be controlled through external contacts.

When output-on inhibit is enabled, the output will not turn on even when the OUTPUT key is pressed. Nor can it be turned on through external control.

The following example shows an example of output control when output-on inhibit is enabled and a high level signal is used to turn on the output.



■ Programmable signal in (Programmable Signal)

You can query the status of the external signal applied to the pin using SCPI commands.

If you connect the EUT status information, you will be able to monitor the EUT status using commands.

CTRL.1 : Programmable Signal1 In

CTRL.2 : Programmable Signal2 In

CTRL.3 : Programmable Signal3 In

■ Shutdown

Use CTRL.4 for shutdown.

The output can be turned off by force through external contacts. This takes precedence over the feature that turns the output on and off through external contacts. The power module operation is also stopped.

The logical polarity is fixed (positive).

When an active signal is applied, "TRBL-19 EXT. SHUTDOWN" is displayed on the panel.

- Recovery

Turn the POWER switch off.

Clear the active signal input, and then turn the POWER switch on.

Monitoring the operation status

You can externally monitor the following operation status of the product.

There are four channels for monitoring (STAT.1 to STAT.4).

You can select (map) control signals for STAT.1 to STAT.3. STAT.4 is fixed to alarm status.

There are two additional channels (DIO.1, DIO.2) that you can select whether to control through external contacts or monitor the operating status ([p. 193](#)).

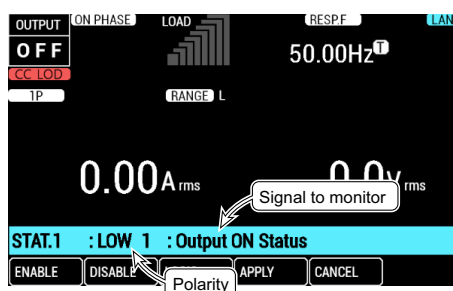
The same control signal can be assigned to multiple channels (STAT.1 to STAT.4, DIO.1, DIO.2).

Signals that can be monitored the operating status		
Output ON status	Output ON Status	
Overload status	Overload Status	
Busy status	Busy Status	
Output method status (1P)	Wiring 1P Status	
Output method status (1P3W)	Wiring 1P3W Status	
Output method status (3P)	Wiring 3P Status	
Output voltage H range status	Volt Range H Status	
POWER switch on status	Power ON Status	
Sequence status output	SEQ Status Out	
Programmable signal status	Programmable Signal	
CC Load mode/CC Supply mode setting status	CC Mode Status	
Alarm status	Alarm Status	Fixed to STAT.4

The output reference phase output and the sequence trigger output can be controlled by setting to "Selectable I/O" ([p. 193](#)).

Set monitoring signals

- 1** Press **CONFIG** (SHIFT+OPR MODE) > **EXT.DIO** (F2) > **STAT.OUT** (F2).
- 2** Select a channel to be set (**STAT.1** (F1)/**STAT.2** (F2)/**STAT.3** (F3)).
STAT.4 is fixed(alarm status). You cannot set this value.
- 3** Press **ENABLE** (F1) to enable monitoring on the assigned channel.
If you want to disable it, press **DISABLE** (F2).
- 4** Use the rotary knob to select the signal for monitoring the operating status.



- 5** Press **LOGIC** (F3) to select the status polarity (**HIGH** (F3)/**LOW** (F4)).
- 6** Press **ESC** to return to the previous screen, and press **APPLY** (F4).
To cancel, press **CANCEL** (F5).
This completes the setting.

■ Output (Output ON Status)

The signal turns on when the output is on.

■ Overload (Overload Status)

The signal turns on when the current limit is exceeded (OVERLOAD indication).

■ Busy (Busy Status)

The signal turns on when the output cannot be turned on (busy status).

■ Output method status (Wiring Status)

Wiring 1P Status is set to on for single-phase output.

Wiring 1P3W Status is set to on for single-phase three-wire output.

Wiring 3P Status is set to on for three-phase output.

When you use two channels, you can check the output method.

■ Output voltage H range status (Volt Range H Status)

The signal turns on when the PCR-WEA is set to H range.

■ POWER switch on status (Power ON Status)

The signal turns on when the POWER switch is turned on.

■ Sequence status (SEQ Status Out)

The signal turns on when the status is being output while a sequence is running.

■ Programmable signal status (Programmable Signal)

Digital signals can be output using SCPI commands.

STAT.1 : Programmable Signal1 Out

STAT.2 : Programmable Signal2 Out

STAT.3 : Programmable Signal3 Out

■ CC Load mode/CC Supply mode setting status

The status turns on when the CC Load or CC Supply mode is selected.

■ Alarm status

The signal turns on when an alarm or trouble is detected.

When the cause of the alarm is resolved, the signal turns off.

Selectable I/O

There are two selectable I/O channels (DIO.1, DIO.2) that you can select whether to control through external contacts or monitor the operating status .

You can select (map) control signals.

When using external contacts for control, the same control signal cannot be assigned to multiple channels (CTRL.1 to CTRL.4, DIO.1, DIO.2).

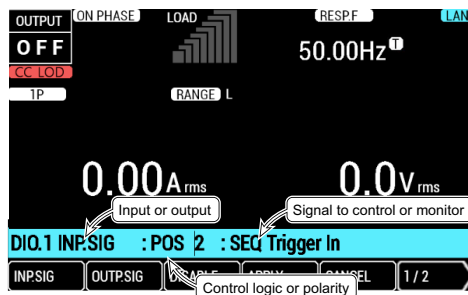
When monitoring the operating status, the same control signal can be assigned to multiple channels (STAT.1 to STAT.4, DIO.1, DIO.2).

Signals controllable through external contacts	
Output reference phase input	Sync Clock In
Sequence trigger input	SEQ Trigger In
Output on/off	Output Control
Sequence run/stop	SEQ Execution Control
Alarm Clear	Alarm Clear
External alarm input	External Alarm
Output method change (1P)	Wiring Control 1P
Output method change (1P3W)	Wiring Control 1P3W
Output method change (3P)	Wiring Control 3P
Output range switching	Volt Range
Preset memory A recall	Recall A Memory
Preset memory B recall	Recall B Memory
Preset memory C recall	Recall C Memory
Output ON inhibit	Output Inhibit
Programmable signal in	Programmable Signal

Signals that can be monitored the operating status	
Output reference phase output	Standard Clock Out
Sequence trigger output	SEQ Trigger Out
Output ON status	Output ON Status
Overload status	Overload Status
Busy status	Busy Status
Output method status (1P)	Wiring 1P Status
Output method status (1P3W)	Wiring 1P3W Status
Output method status (3P)	Wiring 3P Status
Output voltage H range status	Volt Range H Status
POWER switch on status	Power ON Status
Sequence status output	SEQ Status Out
Programmable signal status	Programmable Signal
CC Load mode/CC Supply mode setting status	CC Mode Status

Set selectable I/O signals

- 1 Press **CONFIG** (SHIFT+OPR MODE) > **EXT.DIO** (F2) > **SEL DIO** (F3).
- 2 Select a channel to be set (DIO.1 (F1)/DIO.2 (F2)).
- 3 If you want to control through external contacts, press **INP.SIG** (F1). If you want to monitor the operating status, press **OUTP.SIG** (F2). To disable the channel, press **DISABLE** (F3).
- 4 Use the rotary knob to select the signal to control or monitor.



- 5 Press **1/2** (F6) > **LOGIC** (F3) to select the control logic or status polarity.
 If you want to control through external contacts and set the polarity to high, press **POS**(F3). If you want to set the polarity to low, press **NEG** (F4).
 If you want to monitor the operating status, press **HIGH** (F3) or **LOW** (F4). If you want to set the status polarity to **NORMAL**, press **NORM** (F3). If you want to set it to **INVERTED**, press **INV** (F4).
- 6 Press **ESC** to return to the previous screen, and press **APPLY** (F4).
 To cancel, press **CANCEL** (F5).
 This completes the setting.

Selectable signals when INP.SIG is selected

For details on topics other than the output reference phase input, sequence trigger input, and programmable signal in, see “Control Using Digital Signals” ([p. 183](#)).

■ Output reference phase signal (Sync Clock In)

Apply a signal when you want to synchronize the sync function with an external signal.

■ Sequence trigger input (SEQ Trigger In)

If a signal is applied while a sequence is paused and waiting for a trigger, the pause is released and the sequence resumes.

■ Programmable signal in (Programmable Signal)

You can query the status of the external signal applied to the pin using SCPI commands.

If you connect the EUT status information, you will be able to monitor the EUT status using commands.

DIO.1 : Programmable Signal4 In

DIO.2 : Programmable Signal5 In

Selectable signals when OUTP.SIG is selected

For details on topics other than the output reference phase output, sequence trigger output, and programmable signal status, see Monitoring the operation status ([p. 190](#)).

■ Output reference phase output

A signal for sync function (a signal that inverts its logic at output phase 0° and 180°) is generated.

If the “U PH OFS” icon is displayed (sequence ended with a U phase offset), a phase difference will exist between the reference phase and U phase.

■ Trigger output while a sequence is running

While a sequence is running, a trigger signal is generated when a step whose trigger output is set to on is executed.

■ Programmable signal status (Programmable Signal)

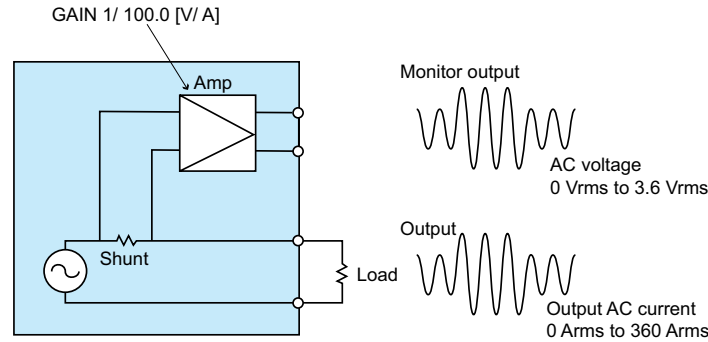
Digital signals can be output using SCPI commands.

DIO.1 : Programmable Signal4 Out

DIO.2 : Programmable Signal5 Out

Analog monitor output (factory option)

On PCR6000WEA2 and higher models (with a power capacity of 6 kW or more), analog monitor output (factory option) is available. Waveform output or level output can be monitored without using a high-voltage differential probe or current probe. For signals that can be output to the analog monitor, see “Signals that can be mapped to the pins” (p.184).



Example:PCR36000WEA2Rsingle-phase
Output current waveform (waveform output)

There are three channels for the monitor output (A, B, C).
The voltage/current waveform outputs have a delay time of approximately 12 μs to 16 μs and are updated in 4 μs cycles.
When the level is output, it is updated at the cycle shown in the table below.

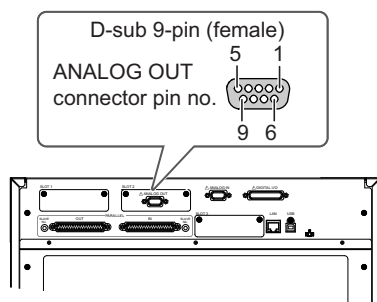
Item	Description
Sync function off	Level outputs such as rms value and average value are updated every measurement cycle depending on the set frequency.
Sync function on	Updated every measurement cycle depending on the input synchronization frequency.
EXTDC mode	Updated every measurement cycle depending on the measurement time (APERTURE). For the setting procedure, see Setting the measurement time (p.174).

ANALOG OUT connector pin arrangement

WARNING

Risk of electric shock.

Use the ANALOG IN connector, ANALOG OUT connector, and DIGITAL I/O connector with an isolation voltage of 42 V_{peak} or less.



Terminal No.	Terminal name
1	Ch. A
2	Ch. B
3	Ch. C
4	--
5	--
6	COM of Ch. A, Ch.B, Ch. C ¹
7	
8	
9	--

1. The common lines of the analog input signals, analog output signals, digital input signals, and selectable input signals are not isolated.

Signals that can be mapped to the pins

The signals to be output can be mapped to the channels of the ANALOG OUT connector. The following table shows the signals that can be mapped.

Signal for analog monitor output		1P output	1P3W output	3P output	Factory default
Single-phase output voltage waveform (waveform output)	VOLT WAVE	✓			Ch. A
U-phase output voltage waveform (waveform output)	VOLT1 WAVE		✓	✓	Ch. A
Single-phase measured rms voltage (AC+DC) (level output)	VOLT RMS	✓			
U-phase measured rms phase voltage (AC+DC) (level output)	VOLT1 RMS		✓	✓	
Single-phase average measured voltage (DC) (level output)	VOLT DC	✓			

Signal for analog monitor output		1P output	1P3W output	3P output	Factory default
U-phase average measured phase voltage (DC) (level output)	VOLT1 DC		✓	✓	
U-V phase measured rms line voltage (AC+DC) (level output)	LTLVOLT1 RMS		✓	✓	
Single-phase output current waveform (waveform output)	CURR WAVE	✓			Ch. B
U-phase output current waveform (waveform output)	CURR1 WAVE		✓	✓	Ch. B
Single-phase measured rms current (AC+DC) (level output)	CURR RMS	✓			
U-phase measured rms current (AC+DC) (level output)	CURR1 RMS		✓	✓	
Single-phase average measured current (DC) (level output)	CURR DC	✓			
U-phase average measured current (DC) (level output)	CURR1 DC		✓	✓	
Single-phase output power waveform (waveform output)	POW WAVE	✓			Ch. C
U-phase output power waveform (waveform output)	POW1 WAVE		✓	✓	Ch. C
Single-phase measured active power (AC+DC) (level output)	POW	✓			
U-phase measured active power (AC+DC) (level output)	POW1		✓	✓	
V-phase output voltage waveform (waveform output)	VOLT2 WAVE		✓	✓	
V-phase measured rms phase voltage (AC+DC) (level output)	VOLT2 RMS		✓	✓	
V-phase average measured phase voltage (DC) (level output)	VOLT2 DC		✓	✓	
V-W phase measured rms line voltage (AC+DC) (level output)	LTLVOLT2 RMS			✓	
V-phase output current waveform (waveform output)	CURR2 WAVE		✓	✓	
V-phase measured rms current (AC+DC) (level output)	CURR2 RMS		✓	✓	
V-phase average measured current (DC) (level output)	CURR2 DC		✓	✓	
V-phase output power waveform (waveform output)	POW2 WAVE		✓	✓	
V-phase measured active power (AC+DC) (level output)	POW2		✓	✓	
W-phase output voltage waveform (waveform output)	VOLT3 WAVE			✓	
W-phase measured rms phase voltage (AC+DC) (level output)	VOLT3 RMS			✓	
W-phase average measured phase voltage (DC) (level output)	VOLT3 DC			✓	
W-U phase measured rms line voltage (AC+DC) (level output)	LTLVOLT3 RMS			✓	
W-phase output current waveform (waveform output)	CURR3 WAVE			✓	
W-phase measured rms current (AC+DC) (level output)	CURR3 RMS			✓	
W-phase average measured current (DC) (level output)	CURR3 DC			✓	

Signal for analog monitor output		1P output	1P3W output	3P output	Factory default
W-phase output power waveform (waveform output)	POW3 WAVE			✓	
W-phase measured active power (AC+DC) (level output)	POW3			✓	
N-phase measured rms current (AC+DC) (level output)	CURR NEUT RMS		✓	✓	
N-phase average measured current (DC) (level output)	CURR NEUT DC		✓	✓	
Total measured active power (AC+DC) (level output)	TOTAL POW		✓	✓	
Internal signal source frequency (level output)	FREQ	✓	✓	✓	

Set analog monitor output

- 1** Press **OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > OUTPUT (F2)**.
- 2** Select the channel you want to assign the parameter to.
If you want to set to channel A, press **CH A (F1)**.
If you want to set to channel B, press **CH B (F2)**.
If you want to set to channel C, press **CH C (F3)**.
- 3** Press **MAP (F5)**, and then use the rotary knob to select the signal you want to control.
- 4** Press **APPLY (F4)**.
To cancel, press **CANCEL (F5)**.
- 5** If you want to enable the channel, press **ENABLE (F1)**. If you want to disable it, press **DISABLE (F2)**.
When the product is shipped from the factory, it is set to **DISABLE**.
- 6** Press **APPLY (F4)**.
To cancel, press **CANCEL (F5)**.
This completes the setting.

Finely adjusting the offset and gain

You can finely adjust the offset and gain.

For default settings, see “SYST:EXT:MON:OUTP:ADJ” in the Communication Interface Manual.

■ Adjusting the offset

For monitor output voltage, the offset can be adjusted to ± 200 mV.

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > OUTPUT (F2)
> CH A (F1) /CH B (F2) /CH C (F3) > USR ADJ (F4)
> VMON (F1) /IMON (F2) /WMON (F3) /FMON (F4) > OFFSET (F2).

Item	Title	Description
OFFSET	Ch A/B/C Offset	Sets the offset (-200 to 200, resolution: 1).

Adjusting the gain

You can adjust the gain.

To output a voltage of 1.5 Vac to the monitor output when the output voltage is 150 Vac, adjust the gain to around 1/100.

- 1 Press OTHERS (SHIFT+MEMORY) > EXT ANLG (F4) > OUTPUT (F2)
> CH A (F1) /CH B (F2) /CH C (F3) > USR ADJ (F4)
> VMON (F1) /IMON (F2) /WMON (F3) / FMON (F4) > GAIN (F3).

Item	Title	Description
GAIN	Ch A/B/C Gain	Sets the gain. Voltage setting range: x1/ 1.0 [V/V] to x1/ 100.0 [V/V], resolution: x0.1 Current setting range: x1/ 0.5 [V/A] to x1/ 240.0 [V/A], resolution: x0.1 Power setting range: x1/ 33.33 [V/W] to x1/ 18000 [V/W], resolution: x0.1 to x0.01 Frequency setting range: x1/ 5.0 [V/Hz] to x1/ 1000 [V/Hz], resolution: x0.1

Parallel Operation

Parallel operation

NOTE

- Parallel operation is only possible in the CV Supply mode. Parallel operation is not available for the CC Supply and CC Load modes.
 - Parallel operation is subject to firmware version requirements. Refer to Specification “Parallel operation compatibility table” ([p.224](#)) for details.
-

For details on the parallel operation, see “Parallel Operation” in the User’s manual.

System Settings

Setting the Watchdog Protection (WDP)

For details, see “Setting the Watchdog Protection (WDP)” in the User’s manual.

Displaying/ Changing the Interface Settings

For details, see “Displaying/Changing the Interface Settings” in the User’s manual.

Displaying SCPI Errors

For details, see “Displaying SCPI Errors” in the User’s manual.

Factory Default Settings and Reset Settings

On this product, you can return all the settings to their factory default conditions or return just a portion of the settings to their factory default conditions.

■ Returning all settings to their factory defaults (sanitize)

This will return all settings to the factory default condition and restart the product.

The settings of all the operation modes, the CV Supply, CC Load, and CC Supply modes, will return to the factory default condition.

When parallel operation is in use, set the rotary switches for the address and the number of slave units on the master unit and all slave units to 0, and then sanitize the PCR-WEA2R products.

- 1** Press CONFIG (SHIFT+OPR MODE) > 1/3 (F6) > SANITIZE (F4).
- 2** A confirmation screen will appear, and then press EXEC (F5) > OK (F4).
The PCR-WEA2R will restart and return to the factory default condition.

■ Returning a portion of the settings to their factory defaults (reset)

When the product is reset, part of the settings of only the selected output method (three-phase output, for example) and the operation mode (the CC Load mode, for example) will return to the factory default condition.

This is effective if you want to return only a specific output method and operation mode to the factory default condition.

The following items can be returned to the factory default condition by resetting:

- Panel settings
- Setup memory
- Sequence function

1 Press RESET (SHIFT+6).

2 Press SHIFT+ENT to confirm.

Panel settings will be reset.

Factory default settings

The sanitized and reset settings are shown below. All items marked with ✓ in the “Sanitize” and “Reset” columns return to the factory default setting.

System setting

Item		Factory default	Sanitize	Reset
Operation mode		CV Supply	✓	--
Output method		Three-phase output	✓	--
Key lock		Off	✓	--
Date and time	Auto clock adjustment	On	✓	--
	NTP server setting	ntp.nict.jp	✓	--
	Time zone	UTC	✓	--
RS232C settings		Enabled	✓	--
	Baud rate	19200 bps	✓	--
LAN setting		Enabled	✓	--
	IP address assignment method	Automatic.	✓	--
	Setting of multicast DNS	Enabled	✓	--
	Setting of dynamic DNS	Enabled	✓	--
	Setting of NetBIOS Over TCP/ IP ¹	Enabled	✓	--
USB		Enabled	✓	--
GPIB (option)		Enabled	✓	--
Voltage surge suppression		CV Supply mode, CC Supply mode: On CC Load mode: Off	✓	--
Current offset		0	✓	--
Fine adjustment of U-phase output current		0	✓	--

Item	Factory default	Sanitize	Reset
Fine adjustment of V-phase output current	0	✓	--
Fine adjustment of W-phase output current	0	✓	--
Screen brightness	3	✓	--
Panel setting state when the POWER switch is turned on	AUTO	✓	--
Watchdog protection	Disabled, 60 s	✓	--
External clock (factory option)	Internal	✓	--

1. IPv4 only.

External digital I/ O				
Item		Factory default	Sanitize	Reset
CTRL.1 to CTRL.4	Enable/Disable (for each channel)	Disabled ¹	✓	--
	Signal to be controlled	CTRL.1 Output Control	✓	--
		CTRL.2 SEQ Execution Control	✓	--
		CTRL.3 Alarm Clear	✓	--
		CTRL.4 Shut Down (fixed)	✓	--
	Logical polarity (for each channel)	POS	✓	--
STAT.1 to STAT.4	Enable/Disable (for each channel)	Disabled ¹	✓	--
	Signal to be controlled	STAT.1 SEQ Status out	✓	--
		STAT.2 Output ON Status	✓	--
		STAT.3 Busy Status	✓	--
		STAT.4 Alarm Status (fixed)	✓	--
	Logical polarity (for each channel)	LOW	✓	--
DIO.1/ DIO.2	Enable/Disable (for each channel)	Disabled	✓	--
	Signal to be controlled	DIO.1 When INP.SIG is selected: Sync Clock In, logical polarity POS When OUTP.SIG is selected: SEQ Trigger Out, logical polarity HIGH	✓	--
		DIO.2 When INP.SIG is selected: SEQ Trigger In, logical polarity POS When OUTP.SIG is selected: Standard Clock Out, logical polarity NORM	✓	--

1. Always enabled for CTRL.4 and STAT.4.

Panel settings

Item			Factory default						Sani tize	Re set
			PCR 6000 WEA2R	PCR 12000 WEA2R	PCR 18000 WEA2R	PCR 24000 WEA2R	PCR 30000 WEA2R	PCR 36000 WEA2R		
Frequency			50.00 Hz						✓	✓
Frequency display			CV Supply mode, CC Supply mode: AUTO CC Load mode: S.SOURCE						✓	✓
AC current			0.0 A						✓	✓
DC current			0.0 A						✓	✓
Output condition when the POWER switch is turned on			SAFE						✓	✓
Voltage/current range			L						✓	✓
Upper AC current limit			The rated current × 110 % A						✓	✓
Lower AC current limit			0.0 A						✓	✓
Upper DC current limit			The rated current × 110% A						✓	✓
Lower DC current limit			The negative rated current × 110% A						✓	✓
Upper frequency limit			CV Supply mode: 5000 Hz (500 Hz limit model is 500 Hz) CC Supply mode, CC Load mode: 65.00 Hz						✓	✓
Lower frequency limit			CV Supply mode: 1.00 Hz CC Supply mode, CC Load mode: 45.00 Hz						✓	✓
Upper resistance limit	1P	L range	284.44 Ω	213.33 Ω	284.44 Ω	213.33 Ω	170.67 Ω	142.22 Ω	✓	✓
		H range	284.44 Ω	284.44 Ω	284.44 Ω	284.44 Ω	227.56 Ω	284.44 Ω		
	3P, 1P3W	L range	1280.00 Ω	1280.00 Ω	853.33 Ω	640.00 Ω	512.00 Ω	426.67 Ω		
		H range	1280.00 Ω	1280.00 Ω	853.33 Ω	1280.00 Ω	1024.00 Ω	853.33 Ω		
Lower resistance limit	1P	L range	1.50 Ω	0.75 Ω	0.50 Ω	0.38 Ω	0.30 Ω	0.25 Ω	✓	✓
		H range	6.00 Ω	3.00 Ω	2.00 Ω	1.50 Ω	1.20 Ω	1.00 Ω		
	3P, 1P3W	L range	4.50 Ω	2.25 Ω	1.50 Ω	1.13 Ω	0.90 Ω	0.75 Ω		
		H range	18.00 Ω	9.00 Ω	6.00 Ω	4.50 Ω	3.60 Ω	3.00 Ω		
Upper limit of synchronization delay phase angle			90.0 deg						✓	✓
Lower limit of synchronization delay phase angle			-90.0 deg						✓	✓
Upper limit of synchronization delay phase angle offset			10.0 deg						✓	✓
Lower limit of synchronization delay phase angle offset			-10.0 deg						✓	✓
Current limit operation			TRIP						✓	✓
Current limit trip time			10 s						✓	✓
Output overvoltage protection (OVP)			14.0 V						✓	✓
Positive peak OVP			14.0 V						✓	✓
Negative peak OVP			-14.0 V						✓	✓
Peak OVP trip time			20 μs						✓	✓
Output undervoltage protection (UVP)			0.0 V, not judged						✓	✓
Sync function			CV Supply mode, CC Supply mode: off, 0.0 deg, synchronized with the input power supply CC Load mode: on, 0.0 deg, synchronized with the voltage of the load input terminal						✓	✓

Item			Factory default						Sani tize	Re set
			PCR	PCR	PCR	PCR	PCR	PCR		
			6000 WEA2R	12000 WEA2R	18000 WEA2R	24000 WEA2R	30000 WEA2R	36000 WEA2R		
Synchronization delay phase angle offset			0.0 deg						✓	✓
Output-on phase			Phase control enabled, 0.0 deg						✓	✓
Output-off phase			Phase control disabled, 0.0 deg						✓	✓
Current U-V phase difference			Single-phase three-wire: 180.00° Three-phase: 120.00°						✓	✓
Current U-W phase difference			270.00°						✓	✓
CR function			Off						✓	✓
CR resistance	1P	L range	94.81 Ω	85.33 Ω	94.81 Ω	71.11 Ω	85.33 Ω	71.11 Ω	✓	✓
		H range	97.52 Ω	94.81 Ω	94.81 Ω	94.81 Ω	97.52 Ω	94.81 Ω		
	3P, 1P3W	L range	98.46 Ω	98.46 Ω	94.81 Ω	91.43 Ω	85.33 Ω	85.33 Ω		
		H range	99.42 Ω	98.46 Ω	97.52 Ω	98.46 Ω	97.52 Ω	94.81 Ω		
Number of the waveform bank to execute			0 (sine wave)						✓	✓
Number of the waveform bank to edit			1						✓	✓
Soft start			Off, 0.1 s						✓	✓
Soft stop			Off, 0.1 s						✓	✓
Response			High-speed response (FAST)						✓	✓
Damping frequency	FAST	7500 Hz							✓	✓
	MED.FAST	6500 Hz							✓	✓
	MED.SLOW	6000 Hz							✓	✓
	SLOW	5500 Hz							✓	✓
Compensation			Off						✓	✓
Panel display	Phase	All (Phase voltage display)							✓	✓
	Voltage	Rms voltage							✓	✓
	Current, power, power factor	Rms current							✓	✓
Peak voltage hold time			0 s						✓	✓
Peak current hold time			0 s						✓	✓
Measurement average	Voltage	1							✓	✓
	Current, power, power factor	1							✓	✓
Sleep function			OFF, 60 min						✓	✓
AC coupling			Disabled						✓	✓
Reactive current suppression			Off						✓	✓
Harmonic analysis			Current, all harmonics						✓	✓
Maximum expected power			6 kVA	12 kVA	18 kVA	24 kVA	30 kVA	36 kVA	✓	✓
Recall preset memory			Confirm and recall						✓	✓
Preset Memory (all memories A, B, and C)	AC current	0.0 A							✓	✓
	DC current	0.0 A							✓	✓
	Frequency	50.00 Hz							✓	✓
	Waveform bank Number	0							✓	✓

External analog input			
Item	Factory default	Sanitize	Reset
External analog signal	Not use	✓	✓
EXTDC gain	Rated current of L range	✓	✓
VPROG gain	0.1 x rated current of L range	✓	✓

Analog monitor output (option)					
Item			Factory default	Sanitize	Reset
Enabled/ disabled (for each channel)			Disabled	✓	✓
Parameter to control (for each channel)	1P output	Ch. A	Output voltage waveform	✓	✓
		Ch. B	Output current waveform	✓	✓
		Ch. C	Output power waveform	✓	✓
	1P3W output, 3P output	Ch. A	U-phase output voltage waveform	✓	✓
		Ch. B	U-phase output current waveform	✓	✓
		Ch. C	U-phase output power waveform	✓	✓

Setup memory

Item	Factory default	Sanitize	Reset
Setup memory	According to the factory default settings of items	✓	✓

Waveform bank

Item	Factory default	Sanitize	Reset
Waveform type	Sine	✓	--
User-defined waveform (set only from remote control)	Sine	✓	--
Crest factor	1.40	✓	--
Clip factor	1.0	✓	--

Sequence function

Sequence condition settings			
Item	Factory default	Sanitize	Reset
Starting step number	0	✓	✓
Ending step number	599	✓	✓
Repetition count	1	✓	✓

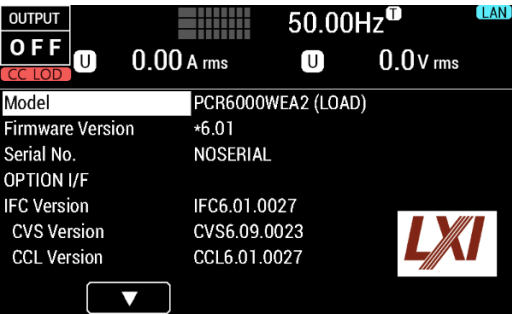
Step settings (all steps)			
Item	Factory default	Sanitize	Reset
AC current	0.0 A, ramp off	✓	✓
Frequency	50.00 Hz, ramp off	✓	✓
DC current	0.0 A, ramp off	✓	✓
CR	off, the maximum value of the setting range (p.214), ramp off	✓	✓
Jump type	Next step	✓	✓
Jump destination step	0	✓	✓
Number of jump repetitions	1	✓	✓
Execution time	10 ms	✓	✓
waveform bank number	0	✓	✓
Output	On	✓	✓
Status output	On	✓	✓
Trigger output	Off	✓	✓
Trigger input	Off	✓	✓
Start phase	Fixed, 0.0 deg	✓	✓
End phase	Free, 0.0 deg	✓	✓
Sudden phase change	Off	✓	✓
U-phase offset	Off, 0.00 deg, ramp off	✓	✓
UV phase difference	Off, 120.00 deg, ramp off	✓	✓
UW phase difference	Off, 240.00 deg, ramp off	✓	✓

Viewing the firmware version

- Check the firmware version of the product.
- The following information also appears:
- Slave unit model information for parallel operation
 - Option board information when an option board is installed

1 Press CONFIG (SHIFT+OPR MODE) > MODEL ID (F5).

The version information is displayed.



Item	Description
Model	Model name ¹
Firmware Version	Firmware version
Serial No.	Serial number
Option I/F	Option board name
	Display example GPIB: GPIB option EXT-MON: Analog monitor output option
IFC Version	Shows the IFC version and the display panel version of each operation mode.
IOC Version	IOC version
PUC Version	PUC version, displayed for each power module
INV Version	Shows the INV version and the input voltage model in [].

1. For the 500 Hz limit model, (500HZ LMT) follows the model name while (LOAD) follows the model name for the models with the constant current output/regenerative electronic load function option.

Update

For details, see “Updating” in the User’s manual.

Maintenance

Maintenance

For details, see "Maintenance" in the User's manual.

Specifications

This chapter describes the specifications of the CC Load and CC Supply modes of the models with the constant current output/ regenerative electronic load function option. For the specifications of the CV Supply mode, see “Specifications” of the User’s Manual.

Main Unit Specifications

Unless specified otherwise, the specifications are for the following settings and conditions.

- The warm-up time is 30 minutes (with current flowing).
- TYP value: Indicates a typical value when the product operates in an environment with an ambient temperature of 23°C. These values do not guarantee the performance of this product.
- setting: Indicates a set value.
- reading: Indicates a readout value.
- f.s.: Indicates full scale.

Input (AC rms)

Model	PCR6000 WEA2R	PCR12000 WEA2R	PCR18000 WEA2R	PCR24000 WEA2R	PCR30000 WEA2R	PCR36000 WEA2R
Voltage (nominal)	200 Vrms to 240 Vrms (three-phase line voltage)					
Voltage (allowable variation range)	170 Vrms to 250 Vrms (three-phase line voltage)					
Frequency (nominal)	50 Hz to 60 Hz					
Frequency (allowable variation range)	45 Hz to 65 Hz					
Apparent power	7.8 kVA or less	15.6 kVA or less	23.4 kVA or less	31.2 kVA or less	39 kVA or less	46.8 kVA or less
Power factor ¹	0.97 (TYP)					
Maximum current	27 A	53 A	80 A	106 A	133 A	159 A
Power outage holding time	10 ms ¹					
Protective conductor current ²	10 mA or less	15 mA or less	20 mA or less	25 mA or less	30 mA or less	35 mA or less

1. At an applied voltage of 100 V/ 200 V, the rated output current, a sine wave, a load power factor of 1, an output frequency of 40 Hz to 1 kHz

2. At an applied voltage of 100 V/ 200 V, the rated output current, a sine wave, a load power factor of 1, DC, and an output frequency of 45 Hz to 65 Hz

Regeneration function

Model		PCR6000 WEA2R	PCR12000 WEA2R	PCR18000 WEA2R	PCR24000 WEA2R	PCR30000 WEA2R	PCR36000 WEA2R
Maximum regenerated power ¹		6 kVA	12 kVA	18kVA	24 kVA	30 kVA	36 kVA
Max. Reverse flow Current ^{1 2}	1P2W	60 A / 30 A	120 A / 60 A	180 A / 90 A	240 A / 120 A	300 A / 150 A	360 A / 180 A
	1P3W, 3P	20 A / 10 A	40 A / 20 A	60 A / 30 A	80 A / 40 A	100 A / 50 A	120 A / 60 A
Regeneration efficiency ³		85% (TYP)					
Output current harmonic distortion		THD: 5 % or less, each harmonic: 3 % or less (2nd to 40th)					

1. When the applied voltage is between 100 VAC and 161 VAC or 200 VAC and 322 VAC, the output current is reduced by the applied voltage.
When the output frequency is between 1 Hz and 40 Hz, the output current is reduced by the output frequency. The output current is 70 % at 1 Hz.
2. At an applied voltage of 100 V/200 V, DC, and an output frequency of 40 Hz to 1 kHz.
(When the current phase is -90 deg to -180 deg/90 deg to 180 deg for the applied voltage)
3. At an applied voltage of 100 V/200 V, the rated output current, a sine wave, a load power factor of 1, DC, and an output frequency of 45 Hz to 65 Hz.

Output

Model					PCR6000 WEA2R	PCR12000 WEA2R	PCR18000 WEA2R	PCR24000 WEA2R	PCR30000 WEA2R	PCR36000 WEA2R		
Phase		1P2W/1P3W/3P4W switchable										
Power capacity ¹				1P2W, 3P		6 kVA	12 kVA	18 kVA	24 kVA	30 kVA	36 kVA	
				1P3W		4 kVA	8 kVA	12 kVA	16 kVA	20 kVA	24 kVA	
CC Load mode / CC Supply mode	A C	Current (L/H range) ²	Rating ³	1P2W	60 A / 30 A	120 A / 60 A	180 A / 90 A	240 A / 120 A	300 A / 150 A	360 A / 180 A		
				3P, 1P3W	20 A / 10 A	40 A / 20 A	60 A / 30 A	80 A / 40 A	100 A / 50 A	120 A / 60 A		
			Setting range	1P2W	0 A to 66 A / 0 A to 33 A	0 A to 132 A / 0 A to 66 A	0 A to 198 A / 0 A to 99 A	0 A to 264 A / 0 A to 132 A	0 A to 330 A / 0 A to 165 A	0 A to 396 A / 0 A to 198 A		
				3P, 1P3W	0 A to 22 A / 0 A to 11 A	0 A to 44 A / 0 A to 22 A	0 A to 66 A / 0 A to 33 A	0 A to 88 A / 0 A to 44 A	0 A to 110 A / 0 A to 55 A	0 A to 132 A / 0 A to 66 A		
			Resolution		0.01 A (0 A to 99.99 A) / 0.1 A (100 A to 999.9 A)							
			Accuracy (phase current)		±(0.3 % of setting + 1 % of f.s) ^{4 5 6 7}							
		Load power factor				0 to 1 (leading or lagging)						
		Frequency setting	Range		1 Hz to 5 kHz (< 40 Hz power de-rating is required)							
			Resolution		0.01 Hz(1.00 Hz to 100.0 Hz)/ 0.1 Hz(100.0 Hz to 1000 Hz) / 1 Hz (1000 Hz to 5000 Hz)							
			Accuracy		±0.01 % ⁴ temperature coefficient: ±0.005 %/ °C							
		Phase setting	Resolution		0.01° ⁸ / 0.1°(1 Hz to 500 Hz) / 1°(500 Hz to 4 kHz) / 2°(>4 kHz)							
			Accuracy		Within ±(0.4°+ fo × 0.9°) fo: Frequency [kHz] ^{4 9}							
	D C	Current (L/H range) ²	Rating ³	1P2W	60 A / 30 A	120 A / 60 A	180 A / 90 A	240 A / 120 A	300 A / 150 A	360 A / 180 A		
				3P, 1P3W	20 A / 10 A	40 A / 20 A	60 A / 30 A	80 A / 40 A	100 A / 50 A	120 A / 60 A		
			Setting range	1P2W	-66 A to 66 A / -33 A to 33 A	-132 A to 132 A / -66 A to 66 A	-198 A to 198 A / -99 A to 99 A	-264 A to 264 A / -132 A to 132 A	-330 A to 330 A / -165 A to 165 A	-396 A to 396 A / -198 A to 198 A		
				3P, 1P3W	-22 A to 22 A / -11 A to 11 A	-44 A to 44 A / -22 A to 22 A	-66 A to 66 A / -33 A to 33 A	-88 A to 88 A / -44 A to 44 A	-110 A to 110 A / -55 A to 55 A	-132 A to 132 A / -66 A to 66 A		
Resolution			0.01 A (0 A to 99.99 A) / 0.1 A (100 A to 999.9 A)									
Accuracy			±(0.3 % of setting + 1 % of f.s) ^{4 10}									

Model				PCR6000 WEA2R	PCR12000 WEA2R	PCR18000 WEA2R	PCR24000 WEA2R	PCR30000 WEA2R	PCR36000 WEA2R	
+CR mode	Resistance ² 11 (L/H range)	Setting range	1P2W	0.30 Ω to 853.33 Ω / 1.20 Ω to 3413.33 Ω	0.15 Ω to 426.67 Ω / 0.60 Ω to 1706.67 Ω	0.10 Ω to 284.44 Ω / 0.40 Ω to 1137.78 Ω	0.08 Ω to 213.33 Ω / 0.30 Ω to 853.33 Ω	0.06 Ω to 170.67 Ω / 0.24 Ω to 682.67 Ω	0.05 Ω to 142.22 Ω / 0.20 Ω to 568.89 Ω	
			3P, 1P3W	0.90 Ω to 2560.00 Ω / 3.60 Ω to 10240.00 Ω	0.45 Ω to 1280.00 Ω / 1.80 Ω to 5120.00 Ω	0.30 Ω to 853.33 Ω / 1.20 Ω to 3413.33 Ω	0.23 Ω to 640.00 Ω / 0.90 Ω to 2560.00 Ω	0.18 Ω to 512.00 Ω / 0.72 Ω to 2048.00 Ω	0.15 Ω to 426.67 Ω / 0.60 Ω to 1706.67 Ω	
		Setting resolution (Phase resistance)		0.01 Ω ¹²						
		Internal resolution	1P2W	1171.875 μS / 292.96875 μS	2343.750 μS / 585.9375 μS	3515.625 μS / 878.90625 μS	4687.500 μS / 1171.875 μS	5859.375 μS / 464.84375 μS	7031.250 μS / 1757.8125 μS	
			3P, 1P3W	390.625 μS / 97.65625 μS	781.250 μS / 195.31250 μS	1171.875 μS / 292.96875 μS	1562.500 μS / 390.625 μS	1953.125 μS / 488.28125 μS	2343.750 μS / 585.9375 μS	
		Accuracy (Phase resistance)		±(1 % of setting + offset) ⁴ ¹³ ¹⁴ ¹⁵ ¹⁶						
		offset	1P2W	0.067 Ω/ 0.267 Ω	0.034 Ω/ 0.134 Ω	0.023 Ω/ 0.089 Ω	0.017 Ω/ 0.067 Ω	0.014 Ω/ 0.054 Ω	0.012 Ω/ 0.045 Ω	
			3P, 1P3W	0.200 Ω/ 0.800 Ω	0.100 Ω/ 0.400 Ω	0.067 Ω/ 0.267 Ω	0.050 Ω/ 0.200 Ω	0.040 Ω/ 0.160 Ω	0.034 Ω/ 0.134 Ω	
Maximum application voltage			AC	±226 Vpeak/ ±452 Vpeak (output L/H range)						
			DC	±226 V/ ±452 V (output L/H range)						
Maximum peak current ¹⁷			4 times the rated current							
Inrush current capability			A current at 1.4 times the rated current for 0.5 s							
Efficiency ¹⁸			85 % (standard value)							

- The power capacity when all power modules are enabled. When any power module is disabled, see the value of an applicable power capacity.
- When the applied voltage is between 100 V and 161 V/200 V and 322 V, the output current is reduced by the applied voltage. When the output frequency is between 1 Hz and 40 Hz, the output current is reduced by the output frequency. The output current is 70 % at 1 Hz.
- Voltage ranges guaranteed by specifications are 1 V to 160 V/2 V to 320 V (AC) and 1.4 V to 226 V/2.8 V to 452 V (DC).
- At an ambient temperature of 23°C±5°C.
- At an output frequency between 45 Hz and 65 Hz.
- At a load power factor of 1, a sine wave, FAST response, and the initial damping frequency.
- At 25% or more of the rated current, when the +CR mode is turned off.
- Only applicable to a case where the waveform bank is 0 and the output frequency is 1 Hz to 500 Hz.
- Within $\pm(0.4^\circ + 2.5 \mu\text{s} \times 360^\circ \times f_o \times 10^3) = \pm(0.4^\circ + f_o \times 0.9^\circ)$ f_o : Frequency [kHz]
Example of angle conversion of the formula in the table at a specific frequency
Within $\pm 0.5^\circ$ (when 60 Hz output) Within $\pm 0.8^\circ$ (when 400 Hz output)
- At a load power factor of 1, FAST response, the initial damping frequency, and the +CR mode OFF.
- The resolution of the CR resistance value has a range that differs between the resolution that can be entered and the resolution that can actually be set. For details, see "Relationship between the setting resolution and the internal resolution of CR resistance value setting" (p.229).
- When the setting resolution [Ω] ≥ the internal resolution [Ω]. For details, see "Relationship between the setting resolution and the internal resolution of CR resistance value setting" (p.229).
- At FAST response and the initial damping frequency.
- For AC voltage applied: A sine wave, 100 V / 200 V in the ranges of an attached table "Accuracy-guaranteed resistance ranges" (p.216). For DC voltage applied: 100 V / 200 V in the ranges of an attached table "Accuracy-guaranteed resistance ranges" (p.216).
- When the current setting is 0 A, the output frequency is 45 Hz to 65 Hz, and in DC.
- An impedance including a reactive current for AC voltage applied.
- Repeated output is possible when the crest factor is 4.
- At an applied voltage of 100 V/200 V, the rated output current, a sine wave, a load power factor of 1, an output frequency of 40 Hz to 1 kHz.

Accuracy-guaranteed resistance ranges

Model	Power capacity	1P3W, 3P		1P2W	
		L range	H range	L range	H range
PCR6000WEA2R	6 kVA	5.00 Ω	20.00 Ω	5.00 Ω to 1.67 Ω	20.00 Ω to 6.67 Ω
PCR12000WEA2R	12 kVA	5.00 Ω to 2.50 Ω	20.00 Ω to 10.00 Ω	3.33 Ω to 0.84 Ω	13.33 Ω to 3.34 Ω
PCR18000WEA2R	18 kVA	5.00 Ω to 1.67 Ω	20.00 Ω to 6.67 Ω	2.22 Ω to 0.56 Ω	8.89 Ω to 2.23 Ω
PCR24000WEA2R	24 kVA	5.00 Ω to 1.25 Ω	20.00 Ω to 5.00 Ω	1.67 Ω to 0.42 Ω	6.67 Ω to 1.67 Ω
PCR30000WEA2R	30 kVA	4.00 Ω to 1.00 Ω	16.00 Ω to 4.00 Ω	1.33 Ω to 0.34 Ω	5.33 Ω to 1.34 Ω
PCR36000WEA2R	36 kVA	3.33 Ω to 0.84 Ω	13.33 Ω to 3.34 Ω	1.11 Ω to 0.28 Ω	4.44 Ω to 1.12 Ω

Output current stability

Model		PCR6000 WEA2R	PCR12000 WEA2R	PCR18000 WEA2R	PCR24000 WEA2R	PCR30000 WEA2R	PCR36000 WEA2R
Response speed ¹ ² (TYP value)	FAST	130 μ s					
	MEDIUM	220 μ s					
	FAST						
	MEDIUM SLOW	500 μ s					
	SLOW	900 μ s					

- At a load power factor of 1 and the initial damping frequency.
- Rise time: The time it takes for the output current to rise from 10 % to 90 % when the output current is changed from the negative rated current to the positive rated current.
Fall time: The time it takes for the output current to fall from 90 % to 10 % when the output current is changed from the positive rated current to the negative rated current.

Measurement

Model		PCR6000 WEA2R	PCR12000 WEA2R	PCR18000 WEA2R	PCR24000 WEA2R	PCR30000 WEA2R	PCR36000 WEA2R
Rms voltage	Resolution	0.1 V					
	Accuracy ¹	$\pm(0.3\% \text{ of reading} + 1 \text{ V})$: DC, 40 Hz to 999.9 Hz $\pm(0.5\% \text{ of reading} + 1 \text{ V})$: 1 kHz to 5 kHz					
Rms current	Resolution	0 A to 99.99 A: 0.01 A 100 A to 999.9 A: 0.1 A					
	Accuracy ^{1 2}	$\pm(0.3\% \text{ of reading} + 0.3\% \text{ of f.s})$: 45 Hz to 65 Hz $\pm(0.6\% \text{ of reading} + 0.6\% \text{ of f.s})$: DC, 40 Hz to 999.9 Hz $\pm(1.2\% \text{ of reading} + 1.2\% \text{ of f.s})$: 1 kHz to 5 kHz					
Current peak	Resolution	0 A to 99.99 A: 0.01 A 100 A to 999.9 A: 0.1 A					
	Accuracy ^{1 3}	4 % of f.s					
Effective power	Resolution ⁴	1W					
	Accuracy ^{1 2 5}	$\pm(0.3\% \text{ of reading} + 0.3\% \text{ of f.s})$: 45 Hz to 65 Hz					
Apparent power	Resolution ⁶	1 VA					
Power factor	Resolution	0.01					
Phase difference	Resolution	0.1°					
Harmonic measurement	Frequency range (fundamental wave)	10 Hz to 1 kHz					
	Upper limit of harmonic analysis	5th to 50th					
	FFT data length	4096					
	Measurement items	Rms voltage and current, phase angle					
Recommended calibration period		1 year					

1. At an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$
2. At 10 % to 100 % of the rated maximum current and a sine wave
3. Pulse height of sine wave
4. When the measured value is 0 W to less than 100 W, the resolution is 0.1 W.
5. At a power factor of 1
6. When the measured value is 0 VA to less than 100 VA, the resolution is 0.1 VA.

Limit values and protection functions

			Setting range	Setting resolution
Setting range limit	AC current	Upper limit	0 A to the maximum current setting	0.01 A / 0.1 A
		Lower limit	0 A to the maximum current setting	0.01 A / 0.1 A
	DC current	Upper limit	The minimum current setting to the maximum current setting	0.01 A / 0.1 A
		Lower limit	The minimum current setting to the maximum current setting	0.01 A / 0.1 A
	Frequency	Upper limit	1.00 Hz to 5000 Hz	0.01 Hz/ 0.1 Hz/ 1 Hz
		Lower limit	1.00 Hz to 5000 Hz	0.01 Hz/ 0.1 Hz/ 1 Hz
Source Voltage drop protection			Fixed	--
Overheat protection (OHP)	Power module overheat protection		Fixed	--
	Fan error		Fixed	--
Overload protection			Rated current or current limit	Current limit resolution
Output overvoltage protection (OVP)	RMS (root mean square)		14.0 V to 500.5 V	0.1 V
	Positive peak value		+14.0 V to +500.5 V	0.1 V
	Negative peak value		-500.5 V to -14.0 V	0.1 V
Output undervoltage protection (UVP)	RMS (root mean square)		0.0 V to 500.5 V	0.1 V
Power module overvoltage protection			Fixed	--
Overcurrent protection (OCP)	Power module overheat protection		Fixed	--
	Output overcurrent protection		10 to 120% of rated current of L range	0.01 A / 0.1 A
Independent operation detection			Fixed	--
Sensing error detection			±(10 % +10 V) with respect to the output terminal voltage	--

Sequence operation

	Setting range	Resolution	Setting accuracy
STEP	0 to 599	1	--
TIME	0.1 ms to 1000 hour	0.1 ms	$\pm(1 \times 10^{-3} + 0.1\text{ ms})$
FREQ	The same as the output frequency setting range		
ACI	The same as the output current setting range		
DCI	The same as the output current setting range		
W.B. No.	The same as the special waveform output setting range		
RESIST	The same as the resistance setting		
PHASE	CV Supply mode: 0.0 deg to 360.0 deg CC Load mode, CC Supply mode: -360.0 deg to 360.0 deg	0.01 deg	$\pm 1\text{ deg } (\leq 1\text{ kHz})$

Special waveform output

	Setting range	Resolution	Setting accuracy
Waveform bank (amplitude: 16 bit, 1 waveform: 4096 points)	0 to 256 (0 for loading only, 236 to 256 for sample waveforms)	1	--
Crest factor	1.10 to 1.40	0.01	± 0.01 ¹

1. Crest factor of the generated waveform data

Output on/off phase setting

	Setting range	Resolution	Setting accuracy
Phase angle setting	0.0 deg to 360.0 deg (0.0 deg = 360.0 deg)	0.1 deg	± 1 deg (≤ 1 kHz)

Communication interface

Software protocol	IEEE Std 488.2-1992
Command language	Complies with SCPI Specification 1999.0
USB	Complies with the USB 2.0 specifications; data rate: 480 Mbps (high speed), socket B type, self-powered
Message terminator	LF or EOM during reception, LF + EOM during transmission
Device class	Compliant with the USBTMC-USB488 device class specifications.
LAN	IEEE802.3, 100Base-TX Ethernet LXI Rev.1.5 2016 (Extended Functions: VXI-11, HiSLIP, IPv6), data rate: 100 Mbps (auto negotiation, Full Speed) AUTO MDIX function IPv4, RJ-45 connector, category 5 or higher, straight cable
Communication protocol	VXI-11, HiSLIP, SCPI-RAW, SCPI-Telnet
Message terminator	VXI-11 and HiSLIP: LF or END during reception, LF + END during transmission SCPI-RAW: LF
RS232C	Complies with the EIA232D specifications, asynchronous full duplex, D-SUB 9-pin connector (male), crossover cable (null modem)
Baud rate	9600 bps/ 19200 bps/ 38400 bps/ 57600 bps/ 115200 bps
Data length	8 bits
Stop bits	1 bit
Parity	None (fixed)
Flow control	NONE/ Xon/ Xoff
Message terminator	LF during reception, CR + LF during transmission
GPIB (option)	Complies with IEEE Std 488.1-1987 SH1, AH1, T8, L4, SR0, RL0, PP0, DC0, DT0, C0, E1 24-pin connector (receptacle)
Message terminator	LF or EOI during reception, LF + EOI during transmission
Primary address	1 to 30

Signal I/O

Insulation resistance	Between primary and terminals	500 VDC, 10 MΩ or more
	Between secondary and terminals	500 VDC, 10 MΩ or more
	Between input and output terminals	Non-isolated (shared common circuit)
Withstand voltage	Between primary and terminals	AC1.5 kV for 1 minute.
	Between secondary and terminals	AC1.5 kV for 1 minute.
Isolation voltage		±42 Vpeak

Analog I/O

At an ambient temperature of $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$

■ Analog input (ANALOG IN connector, Ch.A to Ch.C)

Number of channels		3ch ¹
Terminal		DSUB 9-pin connector (female), #4-40 inch screws
Input resistance		10 k Ω ± 10 % (unbalanced)
Maximum allowable input voltage		± 12 V
Control system selection		EXTDC mode / VPROG mode
Input voltage range		± 10 V
Gain	Setting range	See separate table "Gain setting range" (p.221).
	Setting resolution	0.01
Offset adjustment range		± 200 (equivalent to ± 200 mV through input voltage conversion): the default of 0
EXTDC mode		Amplifies the input waveform.
Vprog mode		The amplitude or frequency of an output voltage waveform can be changed by DC input signals.
Output current error		± 2.5 % of full scale (when gain and offset are default values)
Setting delay time		10 μs (TYP)

1. The common lines of the analog input signals, analog output signals, digital input signals, and selectable input signals are not isolated.

Gain setting range

Output current [A] = gain setting $\times$ applied voltage [V]

(Example) When the gain setting of CH. A in the EXTDC mode is set to "x10.00" and "2.0 V" is applied to the CH.A terminal,

the output current of the U phase is "20.0 A."

Model	Power capacity	EXTDC mode				Vprog mode			
		1P3W, 3P		1P		1P3W, 3P		1P	
		Lower limit value	Upper limit value	Lower limit value	Upper limit value	Lower limit value	Upper limit value	Lower limit value	Upper limit value
PCR6000WEA2R	6 kVA	1.00	160.0	3.00	480.0	1.00	40.00	3.00	120.0
PCR12000WEA2R	12 kVA	2.00	320.0	6.00	960.0	2.00	80.00	6.00	240.0
PCR18000WEA2R	18 kVA	3.00	480.0	9.00	1440	3.00	120.0	9.00	360.0
PCR24000WEA2R	24 kVA	4.00	640.0	12.00	1920	4.00	160.0	12.00	480.0
PCR30000WEA2R	30 kVA	5.00	800.0	12.00	2400	5.00	200.0	15.00	600.0
PCR36000WEA2R	36 kVA	6.00	960.0	18.00	2880	6.00	240.0	18.00	720.0

■ Analog output (factory option, ANALOG OUT connector, Ch.A to Ch.C)

Number of channels		3ch ¹
Terminal		DSUB 9-pin connector (female), #4-40 inch screws
Output impedance		1 k Ω $\pm$ 10 %
Output range		$\pm$ 10 V
Gain	Voltage [V/V]	1/1.0 to 1/100.0
	Current [V/A]	1/0.50 to 1/240.0
	Power [V/VA]	1/33.33 to 1/18000
	Frequency [V/Hz]	1/5.0 to 1/1000
Output error		Measurement error of the monitored signal + 3% of f.s (when gain and offset are adjusted to the default values)
Monitored signal selection		Voltage, current, power, or frequency of each phase
Offset adjustment setting range		-200 to +200 (equivalent to $\pm$ 200 mV through monitor output voltage conversion), resolution: approx. 1 mV

1. The common lines of the analog input signals, analog output signals, digital input signals, and selectable input signals are not isolated.

Digital input/output (DIGITAL I/O connector)

Terminal	DSUB 25-pin connector (female), #4-40 inch screws
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■ Digital input (CTRL.1 to CTRL.4)

Number of channels		4ch (1ch is fixed input) ¹
Input		The maximum open-circuit voltage across input pins is approximately 12 V, and the maximum short-circuit current is approximately 7.1 mA. The internal circuit is pulled up to 12 V by a 1.7 k Ω resistor. High-level input voltage: 11 V to 12 V, or open Low-level input voltage: 0 V to 1 V
Selectable input signals	DISABLE	No enabled functions
	Output Control	Output on/off
	SEQ Execution Control	Sequence run/stop
	Alarm Clear	Alarm Clear
	External Alarm	External alarm input
	Wiring Control 1P	Output method change (1P)
	Wiring Control 1P3W	Output method change (1P3W)
	Wiring Control 3P	Output method change (3P)
	Volt Range	Output range switching
	Recall A Memory	Preset memory A recall
	Recall B Memory	Preset memory B recall
	Recall C Memory	Preset memory C recall
	Output Inhibit	Output-on inhibit
	Programmable Signal	Programmable signal in
Fixed input signal	Shut Down	Shutdown (positive logic fixed)
Logical polarity		Invertible

1. The common lines of the analog input signals, analog output signals, digital input signals, and selectable input signals are not isolated.

Digital output (STAT.1 to STAT.4)

Number of channels	4ch (1ch is fixed output) ¹	
Output	Photocoupler open collector output (30 Vdc, 8 mAmax)	
Selectable output signals	DISABLE	No enabled functions
	Output ON Status	Output ON status
	Overload Status	Overload status
	Busy Status	Busy status
	Wiring 1P Status	Output method status (1P)
	Wiring 1P3W Status	Output method status (1P3W)
	Wiring 3P Status	Output method status (3P)
	Volt Range H Status	Output voltage H range status
	POWER ON Status	POWER switch on status
	SEQ Status Out	Sequence status output
	Programmable Signal	Programmable signal status
	CC Set Status	CC Load mode/CC Supply mode setting status
Fixed output signal	Alarm Status	Alarm status
Logical polarity	Invertible	

1. The common is separate for each channel. Keep the voltage across commons 30 V or less.

Selectable I/O (DIO.1 to DIO.2)

Number of channels	2ch ¹	
Input	Low-level input voltage	0 V to 0.8 V
	High-level input voltage	2 V to 5 V
Output	Low-level output voltage	0 V to 0.55 V
	High-level output voltage	3.8 V to 5 V
	Low-level sink current	12 mA
Selectable input signals	DISABLE	No enabled functions
	Sync Clock In	Output reference phase input
	SEQ Trigger In	Sequence trigger input
	Output Control	Output on/off
	SEQ Execution Control	Sequence run/stop
	Alarm Clear	Alarm Clear
	External Alarm	External alarm input
	Wiring Control 1P	Output method change (1P)
	Wiring Control 1P3W	Output method change (1P3W)
	Wiring Control 3P	Output method change (3P)
	Volt Range	Output range switching
	Recall A Memory	Preset memory A recall
	Recall B Memory	Preset memory B recall
	Recall C Memory	Preset memory C recall
	Output Inhibit	Output-on inhibit
	Programmable Signal	Programmable signal in

Selectable output signals	DISABLE	No enabled functions
	Standard Clock Out	Output reference phase output
	SEQ Trigger Out	Sequence trigger output
	Output ON Status	Output ON status
	Overload Status	Overload status
	Busy Status	Busy status
	Wiring 1P Status	Output method status (1P)
	Wiring 1P3W Status	Output method status (1P3W)
	Wiring 3P Status	Output method status (3P)
	Volt Range H Status	Output voltage H range status
	POWER ON Status	POWER switch on status
	SEQ Status Out	Sequence status output
	Programmable Signal	Programmable signal status
	CC Set Status	CC Load mode/CC Supply mode setting status
Logical polarity		Invertible

- The common lines of the analog input signals, analog output signals, digital input signals, and selectable input signals are not isolated.

Parallel operation

- The product in the CC Load or CC Supply mode cannot perform parallel operation.
- The CV Supply mode allows parallel operation. Parallel operation is subject to combination restrictions. Refer to the table below for details.

Parallel operation compatibility table

			Slave unit					
			PCR-WE/ WE2 series	PCR-WEA/WEA2 series		PCR-WEA2R Constant current output/regenerative electronic load option–equipped model Ver.6.xx		
				Ver.3.xx	Ver.4.xx	CV Supply	CC Load	CC Supply
Master unit	PCR-WE/WE2 series		✓	✓	✓	✓	--	--
	PCR-WEA/WEA2 series	Ver.3.xx	--	✓	✓	✓	--	--
		Ver.4.xx	--	✓	✓	✓	--	--
	PCR-WEA2R Constant current output/ regenerative electronic load option–equipped model Ver.6.xx	CV Supply	--	✓	✓	✓	--	--
		CC Load	--	--	--	--	--	--
		CC Supply	--	--	--	--	--	--

- PCR-WE/WE2 series requires firmware version 1.50 or later.
- The PCR-WEA/WEA2 series Ver.3.xx model requires firmware version 3.32 or later.
- The PCR-WEA/WEA2 series Ver.4.xx model requires firmware version 4.20 or later.
- PCR-WEA2R Constant current output/regenerative electronic load option–equipped model requires firmware version 6.02 or later.

Memory

■ Internal memory

ABC memory (3 memories) and 10 setup memories

■ USB memory device

Waveform bank data, internal memory, panel settings, and sequence data can be saved.

Sync function

The frequency and phase of an output voltage can be synchronized with the input power supply (50 Hz or 60 Hz), the external input clock (50 Hz or 60 Hz), or the output terminal (45 Hz to 65 Hz).

Specifications at output terminal synchronization ^{1 2}

Detectable voltage	10 Vrms (Min)
Sync accuracy ³	±4 deg (TYP value)

1. At an ambient temperature of 23°C ± 5°C
2. At an output frequency of between 45 Hz and 65 Hz
3. When an AC voltage of 100 V/ 200 V in a sine wave is applied and at a sine wave, the rated current, FAST response, and the initial damping frequency

Compensation function

Hard sensing (no limitation on response setting selection)

Response function selection

- High-speed response (FAST: F) mode
- Medium-speed response (MED FAST: MF) mode
- Stable response (MED SLOW: MS) mode
- High stability response (SLOW: S) mode

Ecology function

- Sleep function
- Power-saving function

Soft start and soft stop functions



■ Soft start

Rise time setting range: 0.1 s to 30 s

■ Soft stop

Fall time setting range: 0.1 s to 3 s

General

		PCR6000 WEA2R	PCR12000 WEA2R	PCR18000 WEA2R	PCR24000 WEA2R	PCR30000 WEA2R	PCR36000 WEA2R
Insulation resistance	Between Input or output and the housing	500 VDC, 10 MΩ or more					
	Between input and output						
Withstand voltage	Between Input or output and the housing	1500 VAC/2150 VDC, for 1 minute					
	Between input and output						
Isolation voltage		320 Vrms/452 Vdc					
Electromagnetic compatibility (EMC) 1 2		Complies with the requirements of the following directive and standards. EMC Directive 2014/30/EU EN 61326-1 (Class A ³) EN 55011 (Class A ³ , Group 1 ⁴) Applicable under the following conditions: The maximum length of all cabling and wiring connected to this product must be less than 3 m.					
Safety ¹		Complies with the requirements of the following directive and standards. Low Voltage Directive 2014/35/EU EN 61010-1 (Class I, Pollution Degree 2) ^{5 6}					
Environmental conditions	Operating environment	Indoor use, overvoltage category II					
	Operating temperature range	0 to +50 °C					
	Storage temperature range	-10 to +60 °C					
	Operating humidity range	20 %rh to 80 %rh (no condensation)					
	Storage humidity range	90 %rh or less (no condensation).					
	Altitude	Up to 2000 m					
Dimensions (chassis)		See “Outline drawing” in the User’s manual.					
Weight		43 kg	67 kg	120 kg	130 kg	160 kg	180 kg
Input terminal		M5		3P3W input model: M8 3P4W input model: M5			
Output terminals		M5		M6		M8	
Accessories		See “Accessories” in the User’s manual.					

1. Does not apply to specially ordered or modified products.
2. Only for models with CE or UKCA marking on the panel.
3. This is a Class A instrument. This product is intended for use in an industrial environment. This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.
4. This product belongs to Group 1 products. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/ analysis purpose.
5. This product is a Class I instrument. Be sure to ground this product's protective conductor terminal. The safety of this product is guaranteed only when the product is properly grounded.
6. Pollution is addition of foreign matter (solid, liquid or gaseous) that may produce a reduction of dielectric strength or surface resistivity. Pollution Degree 2 assumes that only non-conductive pollution will occur except for an occasional temporary conductivity caused by condensation.

Outline drawing

For details, see “Outline drawing” in the User’s manual.

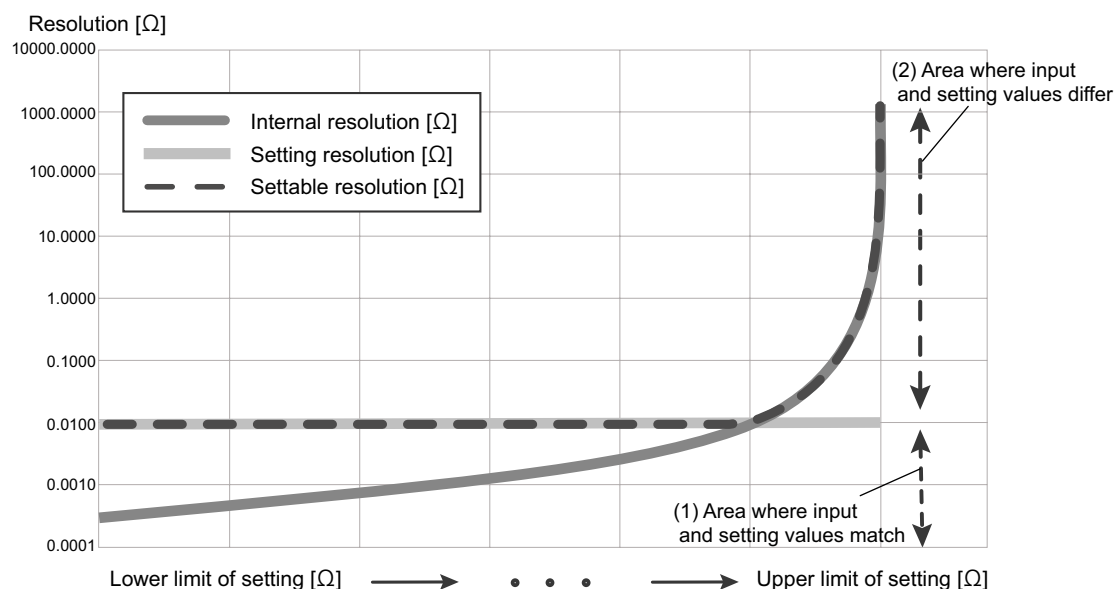
Appendix

Relationship between the setting resolution and the internal resolution of CR resistance value setting

On PCR-WEA, an input value and an actual setting match because the internal resolution is finer than the precision setting (0.01 Ω) when a lower CR resistance is to be set.

If a higher CR resistance is set, however, the internal resolution will become rougher and there will be a region where an actual CR resistance setting and an input value do not match (the configurable resolution will be greater than 0.01 Ω).

The following shows the relationship between the setting resolution and the internal resolution of the CR function.



How to read the chart

Setting resolution [Ω]: The minimum resolution for inputting resistance values is constantly 0.01 Ω .

Internal resolution [Ω]: The resistance resolution when the internal resolution (conductance) is changed.

Settable resolution [Ω]: The actual resolution at which resistance can be set on the PCR-WEA.

■ (1) When the setting resolution $\geq$ internal resolution

The entered resistance value (resolution: 0.01 Ω) is set.

(1) Guideline for resistance settings that satisfy “setting resolution $\geq$ internal resolution”				
Model	3P/1P3W		1P	
	L range	H range	L range	H range
PCR6000WEA2R	5.00 Ω or less	10.00 Ω or less	3.00 Ω or less	5.50 Ω or less
PCR12000WEA2R	3.50 Ω or less	7.00 Ω or less	2.00 Ω or less	4.00 Ω or less
PCR18000WEA2R	3.00 Ω or less	6.00 Ω or less	1.70 Ω or less	3.50 Ω or less
PCR24000WEA2R	2.50 Ω or less	5.00 Ω or less	1.50 Ω or less	3.00 Ω or less
PCR30000WEA2R	2.25 Ω or less	4.50 Ω or less	1.30 Ω or less	2.50 Ω or less
PCR36000WEA2R	2.00 Ω or less	4.00 Ω or less	1.20 Ω or less	2.00 Ω or less

■ (2) When the setting resolution < internal resolution

The entered resistance value is set to the higher resistance value in the internal resolution.

How to calculate a resistance from the internal resolution

A configurable resistance can be calculated by incrementally increasing n in the following formula:

$$\text{Settable resistance } [\Omega] = \frac{1}{\{(\text{Internal resolution } [S]) \times n\}}$$

Power regeneration function

For details, see “Power Regeneration Function” in the User’s Manual.

Options

For details, see “Options” in the User’s Manual.

Troubleshooting

This section introduces troubleshooting measures. Typical symptoms are listed. Check whether any of the items listed below apply to your case. In some cases, the problem can be solved quite easily.

If following the remedy does not solve your problem, contact your Kikusui agent or distributor.

■ OUTPUT cannot be turned on in CC Load mode (ALM-00:OVP display)

Check	Possible cause	Remedy
Whether the OVP (overvoltage protection) is set correctly.	The OVP setting voltage value is too low.	The factory default setting of OVP, +PKOVP, and -PKOVP in the CC Load mode is 14.0 V (or -14.0 V) and that of PKOVP Trip Time is 20 μ s. Change the OVP and peak OVP trip time settings.

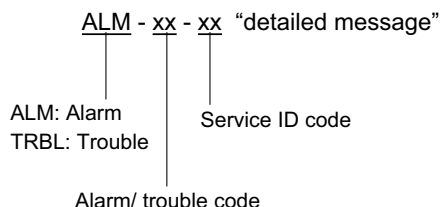
■ Parallel operation is not possible

Check	Possible cause	Remedy
Whether the master and slave units have firmware versions that support parallel operation.	The firmware version does not support the parallel operation combinations.	Refer to the "Parallel operation compatibility table" (p.224) in the specifications to check the firmware version.
Whether the operating mode is CV Supply mode.	The master or slave unit is not in CV Supply mode.	Parallel operation is only possible in CV Supply mode. Change the operation mode.

Alarms and Troubles

Overview

When a protection function is activated, an alarm or a trouble indication is generated, and the output is turned off. Press ALM CHK (F5) to view the details.



■ Alarm

An alarm occurs to indicate that a protection function has been activated. Press ALM CLR (SHIFT+CLR) to clear the alarm, and then fix the problem that caused the alarm.

■ Trouble

A trouble occurs when the product is used improperly or when there is a risk of damage to the product or EUT. Turn the POWER switch off, wait at least 5 seconds, and then turn it back on. If the same trouble indication occurs again, contact your Kikusui agent or distributor to request repairs.

If multiple alarms occur, only the first alarm will be displayed. To display the other alarms that are occurring, press ALM CHK (F5), and then turn the rotary knob.

The detailed message may reveal where the alarm or trouble occurred.

Example: When alarm (ALM-06: OVERLOAD) will occurs, pressing ALM CHK (F5) displays "ALM-06-04 OVERLOAD V." The detailed message shows that the overload protection was activated on the V phase.

When contacting your Kikusui agent or distributor to request repairs, tell the agent or distributor the error number or trouble number that occurred.

Remedy

Alarm numbers and their remedies

Alarm number		Symptom and remedy
ALM-00 OVP		The output overvoltage protection has been activated. This occurs when the measured rms voltage exceeds the OVP setting for approximately 100 ms to 200 ms. In addition, this occurs if the peak of voltage exceeds the peak OVP setting continuously for the set trip time.
ALM-01 P.U ERR		The internal Vcc overvoltage protection has been activated. A voltage greater than or equal to the set voltage has been regenerated from the output side of the PCR-WEA, or the output wires may have shorted during single-phase three-wire output or three-phase output. Alternatively, the PCR-WEA may be malfunctioning. If the alarm occurs even after you fix the problem that caused the alarm, stop using the PCR-WEA Series immediately, and contact your Kikusui agent or distributor to request repairs.
ALM-02 P.U OHP		The overheat protection has been activated. The internal temperature is abnormally high. Leave the product on, and wait for approximately 10 minutes. If the alarm has stopped occurring after 10 minutes, the PCR-WEA may have been installed incorrectly, or the dust filter may be clogged. If there are no problems, contact your Kikusui agent or distributor to request repairs.
ALM-02 OPP	ALM-02-13 UNBALANCE POWER L1	The power limit protection has been activated. The output power of the internal inverter L1/L2/L3 is biased. When using single-phase output or parallel operation, check the wiring. If there are no problems, contact your Kikusui agent or distributor to request repairs.
	ALM-02-14 UNBALANCE POWER L2	
	ALM-02-15 UNBALANCE POWER L3	
ALM-03 OCP	ALM-03-03 UNBALANCE CURR L1	The current limit protection has been activated. The output current of the internal inverter L1/L2/L3 is biased. When using single-phase output or parallel operation, check the wiring. If there are no problems, contact your Kikusui agent or distributor to request repairs.
	ALM-03-04 UNBALANCE CURR L2	
	ALM-03-05 UNBALANCE CURR L3	
	ALM-03-06 OCP (L/U)	The overcurrent protection (OCP) has been activated. This occurs if the U-phase or L1 exceeds the OCP setting continuously for approximately 100 to 200 ms.
	ALM-03-07 OCP (L.2/V)	The overcurrent protection (OCP) has been activated. This occurs if the V-phase or L2 exceeds the OCP setting continuously for approximately 100 to 200 ms.
	ALM-03-08 OCP(L.3/W)	The overcurrent protection (OCP) has been activated. This occurs if the W-phase or L3 exceeds the OCP setting continuously for approximately 100 to 200 ms.
ALM-04 P.U FAN ERR		Fan error
ALM-06 OVERLOAD		The overload protection function has been activated. The output current has exceeded the rated value or the current limit. Fix the problem that caused the overload to occur, and then press OUTPUT again. The overload should be cleared, and the output should turn on.

Alarm number	Symptom and remedy
ALM-07 UVP	The output undervoltage protection has been activated. This occurs when the measured rms voltage is lower than the UVP setting for approximately 100 ms to 200 ms.
ALM-08 P.U FAULT	Power module paused.
ALM-08-00 P.U FAULT(ALL)	All the power modules are paused.
ALM-08-01 P.U FAIL	Power module malfunction. At least one of the power modules has malfunctioned. Contact your Kikusui agent or distributor to request repairs. If this alarm occurs for some of the power modules, you can clear the alarm and use the product temporarily.
ALM-10 WDOG TIMEOUT	The communication monitoring (watchdog) function has activated. This is activated when an SCPI command is not received for the specified period.
ALM-11 P.U INPUT VOLT	An input open phase was detected. There may be a problem with the input wiring or an interruption may have occurred. Turn the power off, check the input wiring, and then turn the power back on.
ALM-12 P.U INPUT ERR	An input overvoltage or frequency error was detected. There may be a problem with the input wiring. Turn the power off, check the input wiring, and then turn the power back on.
ALM-15 CAL.DATA ERR	Calibration value error. Contact your Kikusui agent or distributor to request repairs.
ALM-19 EXT ALARM	An alarm occurred on the external signal, and the output was turned off.
ALM-20 SYNC ERR	The sync function failed to synchronize. Check whether the input sync signal is normal.
ALM-29 AC INPUT LOW	The input voltage dropped lower than the rated value and then recovered. There may be a problem with the input wiring or an interruption may have occurred. Turn the power off, check the input wiring, and then turn the power back on.
Other alarms or trouble indicators	Contact your Kikusui agent or distributor to request repairs.

Trouble numbers and their remedies

trouble code	Symptom and remedy
TRBL-01 P.U ERR	Power module error. Stop using the product, and contact your Kikusui agent or distributor to request repairs.
TRBL-03 HW FAILURE	The internal circuit protection has been activated. Contact your Kikusui agent or distributor to request repairs.
TRBL-06 P.U UNDETECTED	Not all of the power modules can be detected. Contact your Kikusui agent or distributor to request repairs.
TRBL-11 P.U SWITCHING ERR	Internal switch status error. Contact your Kikusui agent or distributor to request repairs.
TRBL-14 HW FAILURE	Internal communication error, ROM value error, etc. Sanitize and return to the factory default condition. If the problem is not resolved, contact your Kikusui agent or distributor for repair.
TRBL-19 EXT. SHUTDOWN	The output was turned off with a shutdown signal received through the external contact. Check whether the included external control connector is connected to the DIGITAL I/O connector. Turn the power off and then back on.

trouble code		Symptom and remedy
TRBL-20	MEAS FAIL	Measurement error. Contact your Kikusui agent or distributor to request repairs.
TRBL-22	VERSION ERR	In parallel operation, the combination of the firmware versions of the master unit and slave units are not correct. Update the firmware, and align the versions.
TRBL-23	OPTION ERR	Option board installation error. Install the board correctly. If the board is installed correctly, contact your Kikusui agent or distributor to request repairs.
TRBL-29	AC INPUT LOW	The input voltage has become lower than the rated value. There is a problem with the input wiring. Turn the power off, check the input wiring, and then turn the power back on.
TRBL-31	P.D SYSTEM ERR	Parallel operation system error. The parallel operation configuration is in error. If the addresses and the number of slave units are set correctly, contact your Kikusui agent or distributor to request repairs.
TRBL-31-06	DIFF OPR MODE	An operation mode not compatible with parallel operation was detected. The operation mode of the master unit or slave units is not compatible with parallel operation. Change to the CV Supply mode.
TRBL-35	FW STARTUP FAIL	Startup failure. Contact your Kikusui agent or distributor to request repairs.
TRBL-40-00	OOS OVP L/ U	The internal overvoltage protection has activated. To protect this product, the maximum allowable voltage for the range was detected regardless of the set OVP value. This protection is activated if the maximum allowable voltage is exceeded continuously for 200 μ s. Check the output range and OVP setting value.
TRBL-40-01	OOS OVP L2/ V	
TRBL-40-02	OOS OVP L3/ W	
Other alarms or trouble indicators		Contact your Kikusui agent or distributor to request repairs.

Error messages

If you attempt to set a value that is not possible, the PCR-WEA will generate a beep and an error message.

Error messages	Symptom
+102, "Operation denied (OUTPUT ON)"	Denied because the output is on.
+103 "Operation denied (PROTECTION)"	Denied because a protection function is activated.
+104 "Operation denied (OUTPUT COUPLING)"	Denied because the command is in conflict with the output mode.
+105 "Operation denied (OUTPUT OFF)"	Denied because the output is off.
+106 "Operation denied (TRIP DISABLE)"	Denied because the action to perform when the current limit is exceeded is set to "not to turn the output off (DISABLE)."
+107 "Operation denied (RISE TIME/SIM/SEQ)"	Denied because soft start, power line abnormality simulation, or sequence is in progress.
+108 "Operation denied (WIRING METHOD)"	Denied because the wiring method (single-phase, three-wire or three-phase) is invalid.

Error messages	Symptom
+109 "Operation denied (EXT.OUTPUT OFF)"	Denied because the output has been turned off through external control.
+110 "Operation denied (EXT.SEQ.STOP)"	Denied because a sequence is being executed or stopped through external control.
+111 "Operation denied (V-PROG)"	Denied because the AC voltage output is being controlled with an external signal.
+112 "Operation denied (SOURCE)"	Denied because the command is in conflict with the signal source setting.
+198 "Operation denied (ENTRY)"	Denied because the PCR-WEA is waiting for an ENT key input.
+199 "Operation denied (BUSY)"	Denied because the PCR-WEA is busy.
+201 "Operation denied (FREQ)"	The sequence cannot be executed because there is a step whose frequency is outside its limits.
+202 "Operation denied (VOLT)"	The power line abnormality simulation or sequence cannot be executed because there is a step whose voltage is outside the voltage range or limits.
+203 "Operation denied (PHASE CHANGE)"	The sequence cannot be executed because there is a step whose trigger wait setting and sudden phase change setting are both turned on.
+224 "Conflicts with Out of RANGE (RESistance)"	Resistance out of the CR range was detected during sequence execution.
+229 "Conflicts with Out of RANGE (CURR)"	AC or DC current out of the range was detected during sequence execution.
+247 "Overlaying too much AC+DC current"	AC current + DC current is outside the setting range.
+261 "Conflicts with frequency synchronization"	Synchronization is off or not in synchronization.
+271 "Conflicts with existing AC CURRent (IMMediate)"	AC current is outside the setting range.
+272 "Conflicts with existing AC CURRent (TRIGgered)"	AC current trigger is outside the setting range.
+273 "Conflicts with existing DC CURRent (IMMediate)"	DC current is outside the setting range.
+274 "Conflicts with existing DC CURRent (TRIGgered)"	DC current trigger is outside the setting range.
+275 "Conflicts with soft CURRent LIMit settings"	AC current is outside the setting range of the minimum or maximum AC current value.
+276 "Conflicts with soft CURRent OFFset LIMit settings"	DC current is outside the setting range of the minimum or maximum DC current value.
+277 "Conflicts with existing RESistance"	Resistance is outside the setting range.
+278 "Conflicts with soft RESistance LIMit settings"	Resistance is outside the setting range of the minimum or maximum resistance value.
+279 "Conflicts with existing FREQUENCY SYNChronous DELay"	The synchronization delay phase angle is out of the setting range.
+280 "Conflicts with soft FREQUENCY SYNChronous DELay LIMit settings"	Synchronization delay phase angle is out of the setting range of the minimum or maximum sync delay phase angle.
+281 "Conflicts with existing FREQUENCY SYNChronous DELay OFFSet"	The synchronization delay phase angle offset is out of the setting range.
+282 "Conflicts with soft FREQUENCY SYNChronous DELay OFFSet LIMit settings"	The synchronization delay phase angle offset is out of the setting range of the minimum or maximum synchronization delay phase angle offset.
+301 "Setting Conflict (COMPENSATION)"	Cannot be set because the command is in conflict with the compensation setting.

Error messages	Symptom
+302 "Setting Conflict (CV RESPONSE)"	Configuration is not possible because of the response setting.
+303 "Setting Conflict (RISE TIME)"	Configuration is not possible because the soft start output is in progress or the command is in conflict with the soft start setting.
+304 "Setting Conflict (SYNCRO)"	Cannot be set because the sync function is on.
+305 "Setting Conflict (TRIP)"	Cannot be set because the command is in conflict with the action that is performed when any of the current limits is exceeded.
+306 "Setting Conflict (UNBALANCE PHASE)"	Configuration is not possible because the phase difference is unbalanced.
+308 "Setting Conflict (OUTPUT IMPEDANCE)"	Configuration is not possible because the output impedance is set.
+309 "Setting Conflict (WAVE BANK)"	Configuration is not possible because a waveform other than waveform bank number 0 is in use.
+319 "No information exists for this frame"	No display panel version information exists for each operation mode of the PCR-WE or PCR-WEA unit that was queried.
+321 "No function is assigned to this key."	No function is assigned to the pressed key.

Warranty Period

Before delivery, our products have undergone strict testing and inspections and have been found to comply with the specifications. We offer different warranty periods for different product models. If the product should become defective within the specific warranty period applied to the product model after the date of purchase, we will repair the product or replace it with a new one for free. In a case in which the customer concluded a separate agreement with us regarding the warranty period, the conditions of the warranty period are applied based on such agreement.

Scope of Warranty

If the product should become defective within the warranty period, we will repair the product or replace it with a new one. However, the warranty does not cover:

- Failure or damage caused by use that is not in accordance with the Operation Manual, misuse, or neglect.
- Failure or damage during transportation after delivery.
- Failure or damage caused by improper modification, adjustment, or repair.
- Failure or damage caused by an Act of God, fire, or other events beyond our control.
- Failure or damage caused by use in a corrosive atmosphere, a dusty environment, or an environment where salt damage occurs or contamination by liquid or foreign matters is likely to occur.
- Failure or damage due to causes that are not attributable to us.

Disclaimer

Regardless of the warranty period, in no event shall we be liable for loss of opportunity or profit caused by the failure of our product, or initial or secondary damages, accident compensation, damages to products other than our products, or compensation for other operations caused by unavoidable circumstances that we may or may not have foreseen.

If you find any misplaced or missing pages in the manuals, they will be replaced. If the manual gets lost or soiled, a new copy can be provided for a fee. In either case, please contact your Kikusui agent or distributor. At that time, inform your agent or distributor of the "Part No." written on the front cover of this manual.

Every effort has been made to ensure the accuracy of this manual. However, if you have any questions or find any errors or omissions, please contact your Kikusui agent or distributor.

After you have finished reading this manual, store it so that you can use it for reference at any time.

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