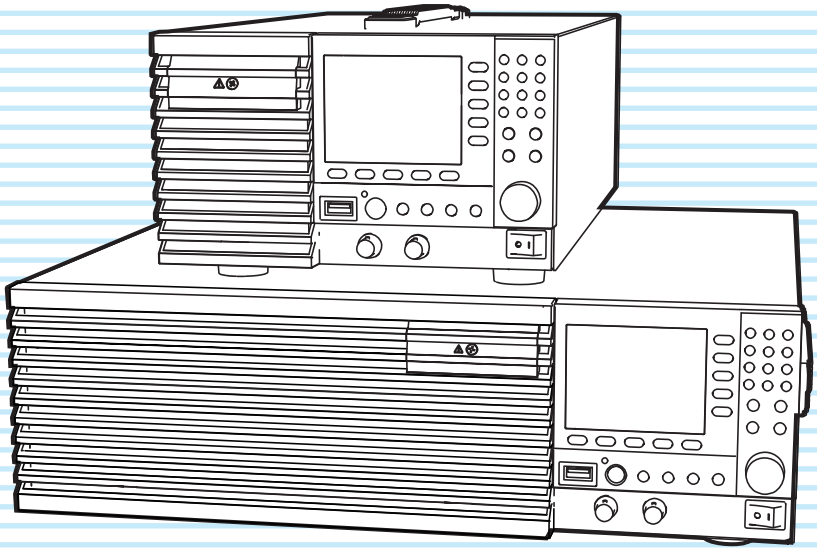
KIKUSUI

PART NO. IB027944
Apr. 2017

User's Manual

PLZ-5W Series Electronic Load

PLZ205W
PLZ405W
PLZ1205W



Contents *5*

Component Names *8*

Installation and Preparation *12*

Basic Functions *19*

Advanced Functions *42*

Sequence Function *58*

External Control *72*

Parallel Operation *83*

System Settings *87*

Maintenance *98*

Specifications *101*

Appendix *110*

About Operation Manual

This manual provides an overview of the 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 manual assumes that the reader has knowledge about power supplies.

Manual construction

- User's manual

(this 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

(partially in PDF)
This document describes remote control. The interface manual is written for readers with sufficient basic knowledge of how to control measuring instruments using a personal computer.

- Quick Reference

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

- Setup Guide

This document is intended for first-time users of the product. It gives an overview of the product, connecting procedures, safety precautions, etc. Please read this manual before you operate the product.

- Safety Information

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

PDF and HTML files are included in the accompanying CD-ROM. Adobe Reader is required to view the PDF files. Microsoft Internet Explorer or Google Chrome is required to view the HTML files.

Firmware versions that this manual covers

This manual applies to products with firmware versions 1.0X. For information on how to check the current firmware version, see “Displaying the Device Information” *(p.97)*.

When contacting us about the product, please provide us with:
The model (marked in the top section of the front panel)
The firmware version *(p.97)*
The serial number (marked on the rear panel)

Trademarks

Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Other company names and product names used in this manual are generally trademarks or registered trademarks of the respective companies.

Copyrights

Reproduction and reprinting of this operation manual, whole or partially, without our permission is prohibited.

Both unit specifications and manual contents are subject to change without notice.

© 2016 Kikusui Electronics Corporation

Checking the Package Contents

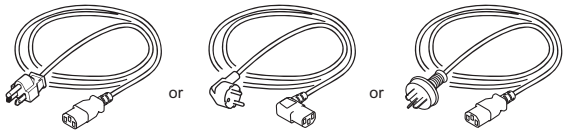
Check that all accessories are included and that the main unit and accessories have not been damaged during transportation.

If any of the unit and accessories are damaged or missing, contact your Kikusui agent or distributor.

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

Accessories

The attached power cord varies depending on the shipment destination.

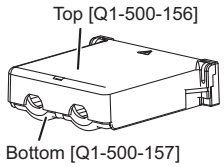


Plug: NEMA5-15
Rating: 125 Vac/10 A
[85-AA-0004]

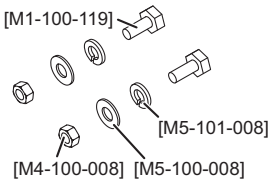
Plug: CEE7/7
Rating: 250 Vac/10 A
[85-AA-0005]

Plug: GB1002
Rating: 250 Vac/10 A
[85-10-0790]

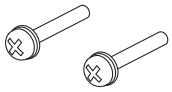
☐ Power cord (1 pc. Cord length: Approx. 2.5 m)



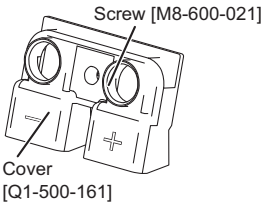
☐ Rear-panel load input terminal cover (1 pc.)



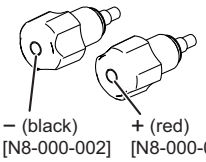
☐ Load input terminal screw set (2 sets)



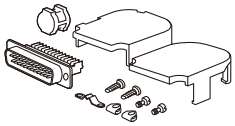
☐ Screws for the rear-panel load input terminal cover (2 pcs.) [M3-112-018]



☐ Front-panel load input terminal cover (1 pc.)



☐ Front-panel load input knob set (1 set)



☐ External control connector kit (1 set) [83-20-0190]

☐ Setup Guide (1 pc.)

☐ CD-ROM (1 disk)

☐ Quick Reference (Japanese 1 sheet, English 1 sheet)

☐ Safety Information (1 pc.)

Product Overview

The PLZ-5W Series Electronic Load is a multifunctional system designed to offer the highest levels of reliability and safety. The electronic load contains a stable and high-performance current control circuit that enables high-speed load simulations. Designed to allow high-precision current setting, it provides outstanding resolution.

Because the electronic load comes standard with RS232C, USB, and LAN communication functions, it can easily be incorporated into a wide range of inspection systems.

PLZ-5W series lineup

Model	Maximum operating current	Operating voltage	Power
PLZ205W	40 A	1 V to 150 V	200 W
PLZ405W	80 A	1 V to 150 V	400 W
PLZ1205W	240 A	1 V to 150 V	1200 W
PLZ2405WB[1]	480 A	1 V to 150 V	2400 W

1 PLZ1205W dedicated booster

Features

In addition to basic constant current, constant resistance, constant voltage, and constant power modes, the PLZ-5W Series offers a variety of other features. The PLZ-5W series also provides better performance than previous models.

High-speed response

The rise time has been improved from 10 µs to 5 µs.

Expanded voltage range

The minimum operating voltage has been improved from 1.5 V to 1.0 V, offering support of low voltage input.

Arbitrary I-V characteristics mode

Arbitrary I-V characteristics mode that allows current to be set arbitrarily in relation to voltage input. This mode can be used for simulation of LED loads and the like.

Color liquid crystal display (LCD)

Allows easy-to-see display in color. The voltage value, current value, power value, current capacity value (Ah), and power capacity value (Wh) at the load input terminal are indicated on the display.

Increased power capacity and current capacity

Power capacity and current capacity 1.2 times those of previous models have been realized while keeping the size unchanged.

Larger capacity achievable

Larger capacity can be achieved by connecting optional boosters (PLZ2405WB) to the PLZ1205W. Up to four booster units can be operated in parallel using a PLZ1205W unit as the master unit (up to 10.8 kW, 2160 A).

Support of synchronized operation

On/off control and the execution of sequences can be synchronized for multiple PLZ-5W units.

RS232C, USB, and LAN communication functions provided as standard

These functions allow easy incorporation into various types of inspection systems.

GPIB function available as option*

Using the optional GPIB converter *(p.133)*, the GPIB function can be used via the RS232C or USB interface.

* Limitation apply to some of the functions.

Notations Used in This Manual

- In this manual, electronic loads PLZ205W, PLZ405W, and PLZ1205W are sometimes referred to as “PLZ-5W”.
- The term “PC” is used to refer generally to both 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 the explanations 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 damage to the product or other property.

NOTE

Indicates information that you should know.

MANUAL

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

Memo

Indicates useful information.

⚠ Safety Precautions

When using this product, be sure to observe the “Safety Precautions” in the Safety information manual. The following precautions pertain only to this product.

Cover

- The rear panel may become hot during operation. If you touch it, you may burn yourself.

⚠ Precautions Concerning Installation Location

When installing this product, be sure to observe the “Precautions Concerning Installation Location” in the Safety information manual. The following precautions pertain only to this product.

- When installing this product, be sure to observe the temperature and humidity ranges indicated below.
  Operating temperature range: 0 °C to 40 °C
  (32 °F to 104 °F)
  Operating humidity range: 20%rh to 85%rh
  (no condensation)
- When storing this product, be sure to observe the temperature and humidity ranges indicated below.
  Storage temperature range: -20 °C to 70 °C
  (-4 °F to 158 °F)
  Storage humidity range: 90 %rh or less (no condensation)
- Do not install the product vertically.
  It may cause injury to the operator or damage to the product when it falls down.

Contents

About Operation Manual 2
Checking the Package Contents 3
Product Overview 3
Notations Used in This Manual 4
Safety Precautions 4
Precautions Concerning Installation Location 4
Component Names 8

1. Installation and Preparation

Rack Mounting the PLZ-5W Series 12
- Removing the handle and the rubber feet 12
- Attaching the rack adapter or bracket 12

Connecting the Power Cord 13
Checking Whether the Power Is On or Off 14
- Turning the power on 14
- Turning the power off 14

Connecting to the Load Input Terminals 15
- Connecting to the load input terminals on the rear panel 15
- Connecting to the load input terminals on the front panel 17
- Notes regarding load input terminals 18

2. Basic Functions

Panel Operations 19
- Using the function keys 19
- Inputting numbers/characters 20

Load On/Load Off 20
Setting the Operation Mode 21
- Setting constant current (CC) mode 21
- Setting constant resistance (CR) mode 21
- Setting constant voltage (CV) mode 22
- Setting constant power (CP) mode 22
- Adding CV mode to CC mode (CC+CV) 23
- Adding CV mode to CR mode (CR+CV) 24
- Setting arbitrary I-V characteristics (ARB) mode 25

Setting the Current Range / Voltage Range 27
Setting the Slew Rate 27
Setting the Short Function 28
Switching Function 29
- Setting the switching level 29
- Setting the switching interval 29
- Turning the switching function on/off 31
- Timing of trigger signal output 31

Alarm Function 32
- Alarm types and operation 32
- Setting overcurrent protection (OCP) 33
- Setting overpower protection (OPP) 33
- Setting undervoltage protection (UVP) 34
- Setting watchdog protection (WDP) 35
- When an alarm occurs 35
- Clearing an alarm 35

Measurement Function 36
- Overview of the measurement function 36
- Starting/stopping measurement 36
- Obtaining the measurement data 36
- Setting triggers 37

Recording Integrated Data 39
- Recording current capacity/power capacity/elapsed time 39
- Displaying the integrated data 41

3. Advanced Functions

Changing the Response Speed 42
Soft Start 43
Remote Sensing 44
- Connecting the sensing cables 44
- Enabling remote sensing 45

Trigger Function 46
Auto Load Off Timer 46
Types of Memory 47
ABC Preset Memories 48
- Saving to ABC preset memories 48
- Recalling ABC preset memory entries 49

Setup Memory 50
- How to view the setup memory edit screen 50
- Saving to the setup memory 50
- Recalling the setup memory 52
- Checking the setup memory details 52

Synchronized Operation 53
- Connection for synchronized operation 53
- Synchronizing the load on/off operation 54
- Synchronizing measurements 55
- Synchronizing the start of sequences 55
- Synchronizing the resuming of sequences 56

Remote Control 57
- Releasing remote control 57

4. Sequence Function

Overview of the Sequence Function 58
Programs and steps 58
Main features 58
Program Settings 59
How to view the program editing screen 59
Creating a program 59
Setting the number of loops of a program 60
Setting the voltage of CV mode addition (+CV) 60
Setting protection functions 61
Changing a program name 61
Deleting a program 62
Setting Steps 63
Creating steps 63
Deleting a step 65
Sequence creation tutorial 65
Newly creating program1 66
Registering steps to program1 66
Executing, Pausing, and Stopping Sequences 69
Executing a sequence 69
Pauses the sequence 69
Stopping a sequence 70
Setting triggers 70

5.External Control

Preparation for External Control 72
Precautions for high-speed load simulations 72
Connecting the EXT CONT connector 73
EXT CONT connector pin arrangement 74
Load Setting Control 75
Constant current (CC), constant resistance (CR), and constant power (CP) control 75
Constant voltage (CV) control 76
Controlling the current to be superimposed on the constant current (CC) 77
Control of Load On/Load Off 78
Load on/off control input 78
Load-on status signal output 79
Control of the Current Range 79
Range control input 79
Range status output 79
Control of the Alarm Signal 80
Alarm input 80
Alarm clearing input 80
Alarm status output 80
Trigger Input/Output 81
Trigger input 81
Trigger output 81
Digital I/O 81
Using the Current Monitor Signal 82
Current monitor output 82

6.Parallel Operation

Overview of Parallel Operation 83
Parallel operation using the same model 84
Performing connections for parallel operation 84
Performing parallel operation 86
Slew rate and response speed settings during parallel operation 86
Protection function during parallel operation (parallel operation anomaly detection) 86
Canceling parallel operation 86

7.System Settings

Displaying/Changing the Basic Settings 87
Panel settings at startup 88
Screen saver 88
Key lock 89
Setting the beep sound 90
Setting the DIGITAL2 signal input/output 90
Displaying/Changing the Interface Settings 91
Resetting the interface settings 92
Returning the interface settings to the factory default settings 92
Displaying SCPI Errors 93
Setting the Date/Time 93
Factory Default Settings and Reset Settings 94
Restoring the factory default settings 94
Restoring the reset settings 94
Main settings at factory default and at reset 95
Updating 97
Displaying the Device Information 97

8.Maintenance

Inspection 98
Cleaning the panels 98
Overhaul 98
Backup battery replacement 98
Calibration 98
Malfunctions and Causes 99

9.Specifications

Ratings 101
Constant current (CC) mode 101

Constant resistance (CR) mode 102
Constant voltage (CV) mode 102
Constant power (CP) mode 103
Arbitrary I-V characteristics (ARB) mode 103
Measurement function 103
Switching function 104
Slew rate 104
Soft start 104
Alarm Feature 105
Sequence function 105
Other functions 106
Common specifications 106
General specifications 108
External dimensions 109

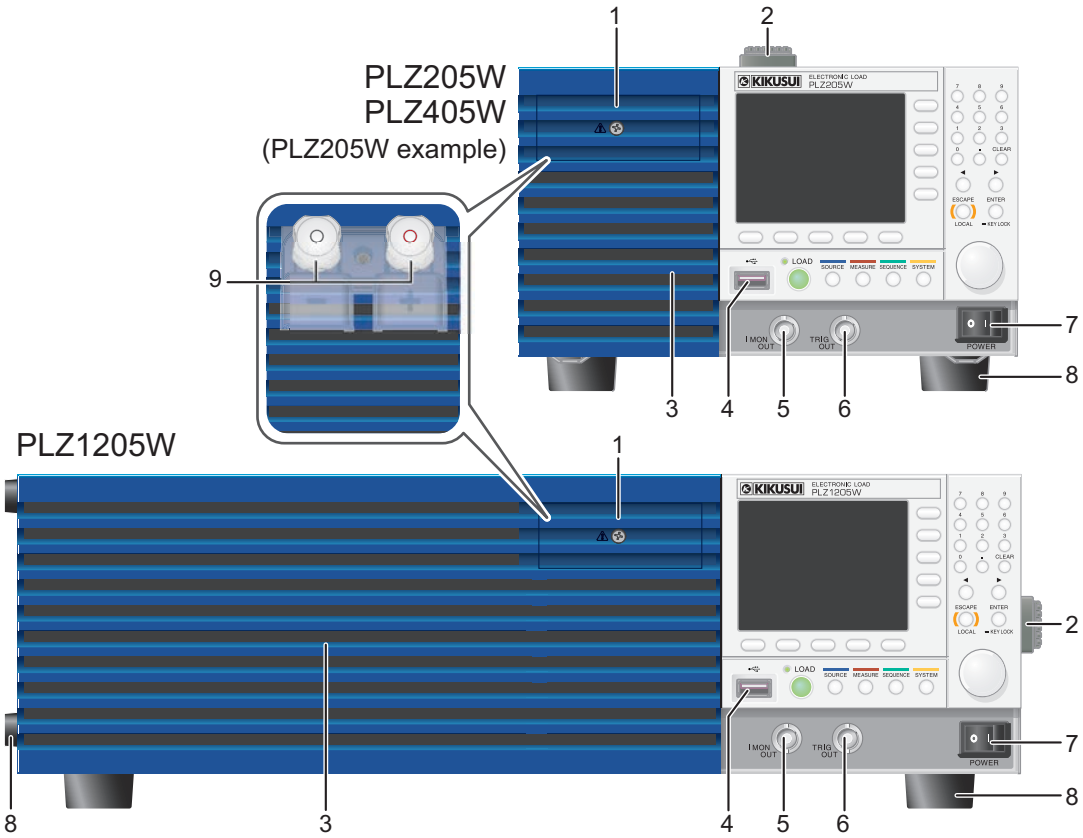
10.Appendix

Selecting the Load Cables 110
Methods to Stabilize Operation 111
Reducing the load cable inductance 111
Optimizing the response speed 112
Using remote sensing 112
Slew Rate for Small Currents 113
Operating Area 114
Basic operation modes 114
Operation of the constant current (CC) mode 115
Operation in constant resistance (CR) mode 116
Constant power (CP) mode operation 118
Constant voltage (CV) mode operation 119
Operation when CV Mode is Added to CC Mode 121
Operation when CV Mode is Added to CR Mode 122
Operating Area of Each Model 124
Response Time and Waveform When an OPP Is Activated 127
Response time 127
waveform 127
Main Specifications for Parallel Operation 129
Parallel operation using the same type of electronic loads 129
Parallel operation using boosters 131
Options 132
Rack adapters, brackets 132
GPIB converter (PIA5100) 133
Parallel operation signal cable kit (PC01-PLZ-5W) 133
Low inductance cable 133
Large current load cable 133

INDEX 134

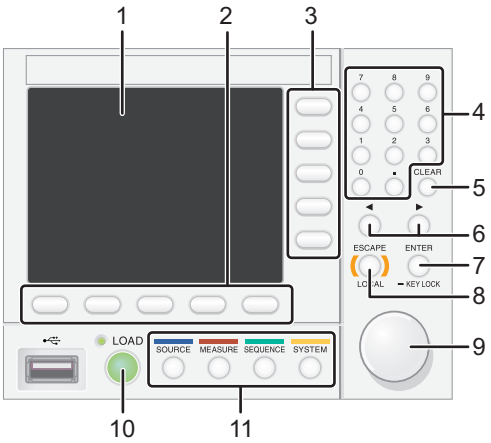
Component Names

Front panel



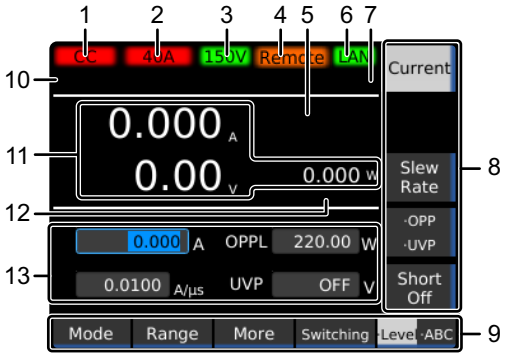
No.	Name	Function	See
1	Protection plate	This plate protects the load input terminal on the front panel. The DUT and the PLZ-5W can be connected by removing the protection plate and attaching the front panel load input terminal cover. When not using the load input terminal on the front panel, be sure to attach the protection plate.	p.17
2	Handle	Handle for carrying the PLZ-5WL.	p.12
3	Air inlet	Inlet holes for cooling.	–
4	USB port (host)	This connector is used to connect an external keyboard and to perform updates.	p.20 p.97
5	I MON OUT connector	Current monitor output terminal.	p.82
6	TRIG OUT connector	Trigger signal output terminal.	p.81
7	POWER switch	Press the (I) side to switch the power on, and the (O) side to switch the power off.	p.14
8	Feet	PLZ205W/PLZ405W: 4 locations on bottom panel. PLZ1205W: 4 locations on bottom panel, 4 locations on side panel.	p.12
9	DC INPUT terminal (Load input terminal on the front panel)	Used for simple connection with the DUT. The specifications are for the load input terminal on the rear panel and the load input terminal on the front panel may not meet the specifications.	p.17

Controls



No.	Name	Function	See
1	Display	Displays the settings, measured values, and other information.	*p.10*
2	Function keys	Each function key executes the item that is displayed above that key (function area).	*p.19*
3	Sub-function keys	Each sub-function key executes the item that is displayed to the left of that key (sub-function area).	*p.19*
4	Numeric keypad	Enters values.	*p.20*
5	CLEAR key	Deletes numbers/characters.	*p.20*
6	◀/▶ keys	Move the cursor left and right. Select the left or right item.	*p.20*
7	ENTER key KEY LOCK key	Confirms the input value when performing numeric keypad input. Confirmation after selection of setting item. Hold down to lock the keys.	*p.20*
8	ESCAPE key LOCAL key	Cancels numeric/character input. Closes the window. Returns remote control to panel operation.	*p.20* *p.57*
9	Rotary knob	Item selection. Inputs numbers/characters.	*p.20*
10	LOAD key	Used to turn load on and off.	*p.20*
11	Menu key	Used to switch the item that is shown on the display.	*p.19*
	SOURCE key	Basic functions including operation modes, current/resistance/power/voltage/slew rate value setting, voltage range, current range, short function, switching function, alarm function, sequence start trigger function, response speed, soft start, external control, auto load off timer, ABC preset memories and load on/off synchronization.	–
	MEASURE key	Function related to measurement, measurement trigger function, measurement functions such as integrated data recording/display.	*p.36* *p.39*
	SEQUENCE key	Functions related to sequence.	*p.58*
	SYSTEM key	Remote sensing, system settings, interface settings, setup memory, display of SCPI errors, date setting, restore factory default setting, update, display of device information.	*p.87*

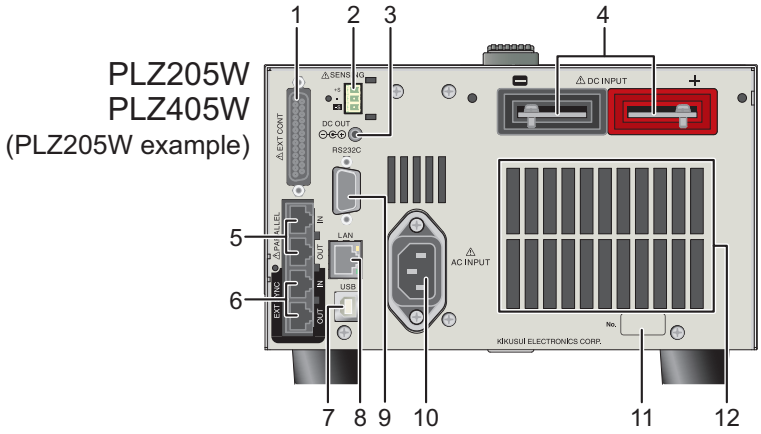
Display



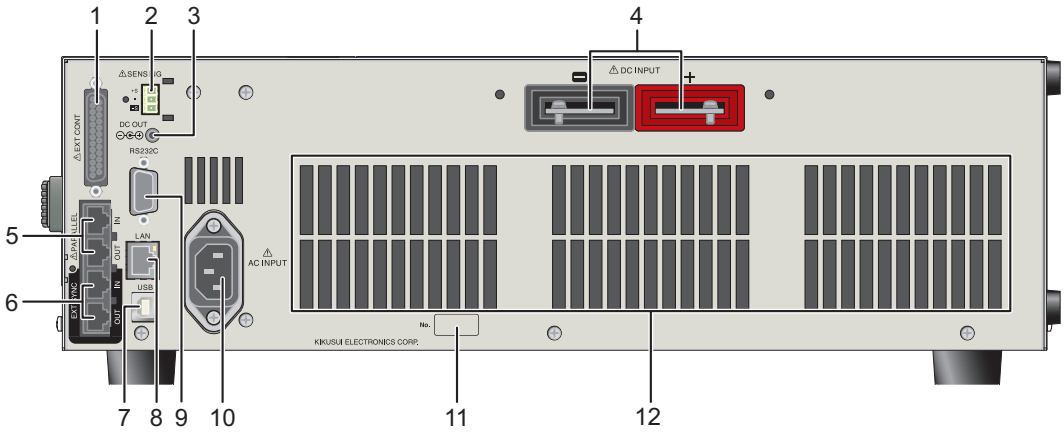
No.	Name	Function	See
1	Setting of operation mode	Displays the currently selected operation mode.	*p.21*
2	Current range	Displays the current range.	*p.27*
3	Voltage range	Displays the voltage range.	*p.27*
4	Remote control mode	Indicates that the product is being controlled remotely.	*p.57*
5	Operation mode	Displays the currently running operation mode.	—
6	LAN connection status	Displays the status of the LAN connection. Green: Communication enabled. Orange: Preparing for communication. Red: Not connected.	—
7	Icon display	—	
		Indicates that the switching function is currently being used.	*p.31*
		Indicates that measured values are being recorded.	*p.36*
		Indicates that remote sensing is in progress.	*p.44*
		Indicates that key lock is on. The key lock level is displayed numerically.	*p.89*
		Sequence in progress.	*p.69*
	Error 1	Displayed when SCPI error occurs. The number of error incidents (up to 16) is displayed numerically.	*p.93*
8	Sub-function area	Indicates that execution is possible with the keys (sub-function keys) in the right side of the display.	*p.19*
9	Function area	Indicates that execution is possible with the keys (function keys) at the bottom of the display.	*p.19*
10	Message area	Displays alarm messages.	*p.32*
11	Measured value display	Displays the current, voltage, and power values. The load input ratio for each rating is displayed in bar graph form under the current value and voltage value.	—
12	Integrated data display	When integrated data display is enabled, displays the integrated data.	*p.41*
13	Value	Displays load settings (current, conductance, voltage, power) and other settings such as slew rate and alarm operating conditions.	—

Rear panel

PLZ205W
PLZ405W
(PLZ205W example)



PLZ1205W



No.	Name	Function	See
1	EXT CONT connector	External control connector. A cover for the pins is provided.	p.72
2	SENSING connector	Remote sensing connector.	p.44
3	DC OUT connector	Used during GPIB converter (option) use.	p.133
4	DC INPUT terminal (load input terminal on the rear panel)	Used to connect the DUT and the PLZ-5W.	p.15
5	PARALLEL connector	Connector for parallel operation.	p.84
6	EXT SYNC connector	Connector for synchronized operation.	p.53
7	USB port (device)	USB port for remote control.	MANUAL Interface Manual
8	LAN port	LAN port for remote control.	
9	RS232C port	RS232C port for remote control.	
10	AC INPUT connector	Power inlet.	p.13
11	Serial number	PLZ-5W manufacturing number.	—
12	Air outlet	Air outlet for cooling.	—

1 Installation and Preparation

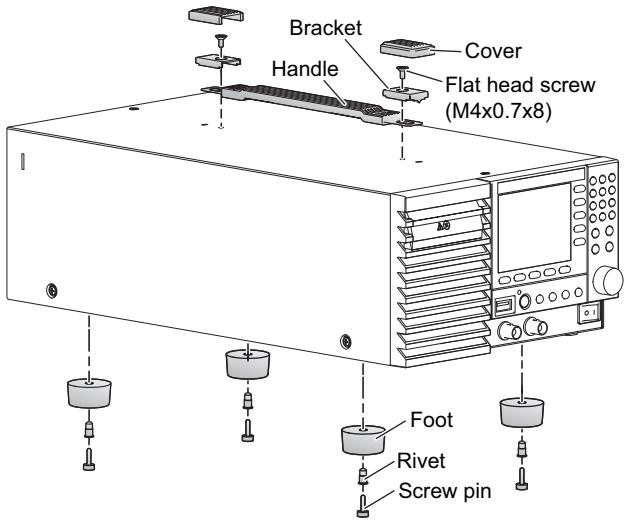
Rack Mounting the PLZ-5W Series

The PLZ-5W can be rack mounted using the optional rack adapter or the optional bracket *(p.132)*. To rack mount the PLZ-5W, remove the handle of the PLZ-5W and the rubber feet.

Removing the handle and the rubber feet

NOTE

- We recommend that you keep all the pieces that you remove from the PLZ-5W. You will need these pieces if you remove the PLZ-5W from the rack. Particularly when reattaching the rubber legs, please use the rivets and screw pins that were removed.
- To reinstall the handle that has been removed, use screw locking agent (e.g., 1401B by ThreeBond International, Inc.) to prevent screws from loosening.



1. **Remove the two handle covers.**
2. **Unfasten the two M4 flat head screws, and remove the entire handle.**
3. **While pulling down the rubber feet (four locations), loosen their screw pin with a screwdriver and remove the feet.**

Attaching the rack adapter or bracket

NOTE

When mounting the PLZ-5W on a rack, be sure to use support angles (auxiliary brackets) to safely support the product.

- When attaching the rack adapter, refer to the KRA3 or KRA150 manual provided on the accompanying CD-ROM.
- When attaching the bracket, refer to the KRB3-TOS or KRB150-TOS manual provided on the accompanying CD-ROM.

Connecting the Power Cord

⚠WARNING **Risk of electric shock.**

- **The PLZ-5W conforms to IEC Safety Class I (equipment that has a protective conductor terminal). Be sure to earth ground the product to prevent electric shock.**
- **The PLZ-5W is grounded through the power cord ground wire. Connect the protective conductor terminal to earth ground.**

NOTE

- Use the supplied power cord to connect to the AC line.
  If the supplied power cord cannot be used because the rated voltage or the plug shape is incompatible, have a qualified engineer replace it with an appropriate power cord that is 3 m or less in length. If obtaining a power cord is difficult, contact your Kikusui agent or distributor.
- The power cord with a plug can be used to disconnect the PLZ-5W from the AC power line in an emergency. Connect the plug to an easily accessible power outlet so that the plug can be removed from the outlet at any time.
- Secure adequate space around the power cord plug. Do not insert the power cord plug into an outlet that is difficult to access or place objects around the power cord plug that will make plugging and unplugging difficult.
- Do not use the supplied power cord with other instruments.

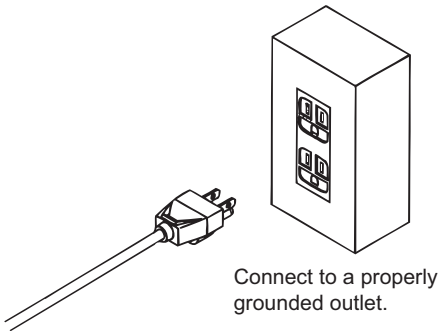
The PLZ-5W conforms to IEC Overvoltage Category II (energy-consuming equipment that is supplied from a fixed installation).

1 **Turn the POWER switch off (○).**

2 **Check that the AC power line meets the nominal input rating of the PLZ-5W.**
The PLZ-5W can receive a nominal line voltage in the range of 100 Vac to 240 Vac at 50 Hz or 60 Hz. (Frequency range: 47 Hz to 63 Hz)

3 **Connect the power cord to the AC INPUT inlet on the rear panel.**

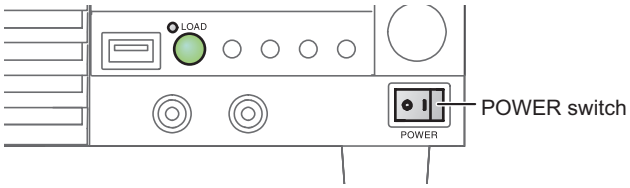
4 **Connect the power cord plug to a properly grounded outlet.**



Connect to a properly grounded outlet.

Checking Whether the Power Is On or Off

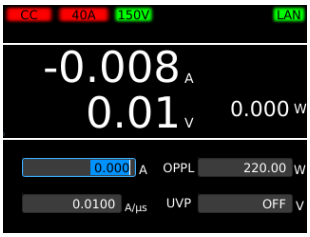
Turning the power on



1 **Check that the power cord is connected correctly.**

2 **Check that nothing is connected to the DC INPUT (load input) terminals on the front and rear panels.**

3 **Turn the POWER switch on (|).**
The display lights.



If you notice strange sounds, unusual odors, fire, or smoke around or from inside the PLZ-5W, flip the POWER switch off, or remove the power cord plug from the outlet.

By factory default, the panel settings immediately before the POWER switch is turned off are saved. If you turn the power on, the PLZ-5W starts in the same state as it was in the last time that it was turned off. (However, the load setting is always Load Off.)

The panel setting state at startup can be changed *(p.88)*.

If the PLZ-5W does not start normally

If the following remedy does not solve the problem, contact your Kikusui agent or distributor.

Status	Remedy	See
Nothing is shown on the display.	Check the power cord connection, and turn the POWER switch off and then back on.	*p.13*
Odd current or power value is displayed.	Turn off the POWER switch and then turn it back on.	–
A protection function has been activated.	Remove the cause of the protection function activation.	*p.32*

Turning the power off

Press the (○) side of the POWER switch to turn the power off.

⚠CAUTION After you turn the POWER switch off, wait at least 5 seconds after the fan stops before you turn the POWER switch back on. Repeatedly turning the POWER switch on and off at short intervals will shorten the service life of the POWER switch and the internal input fuse.

Connecting to the Load Input Terminals

The PLZ-5W has load input terminals on both its front and rear panels. The specifications of the PLZ-5W are for the load input terminals on the rear panel.
For information on selecting load cables, refer to “Appendix” *(p.110)* in the “Selecting the Load Cables”. Large current load cables are available as options. For details, see the Large Current Load Cable Manual on the included CD-ROM.

⚠WARNING **Risk of electric shock.**

- **Do not touch load input terminals when the output is turned on.**
- **The load input terminals on the front panel are connected internally to the load input terminals on the rear panel. The voltage applied to the terminal on one side is transmitted directly to the terminal on the other side.**

⚠CAUTION To avoid damaging the product, observe the following precautions.

- Do not connect the DUT to the load input terminals while the PLZ-5W’s load is turned on.
- Do not connect electronic loads to the load input terminals on the front panel and those on the rear panel at the same time.
- Do not invert the polarity when connecting. An overcurrent might flow when the load is turned on.

To avoid overheating, observe the following precaution.

- Attach crimping terminals to the cables, and use the supplied screws to connect the cables.

Connecting to the load input terminals on the rear panel

Connect the DUT to the load input terminals on the rear panel.

⚠WARNING **Risk of electric shock. Be sure to use the load input terminal cover.**

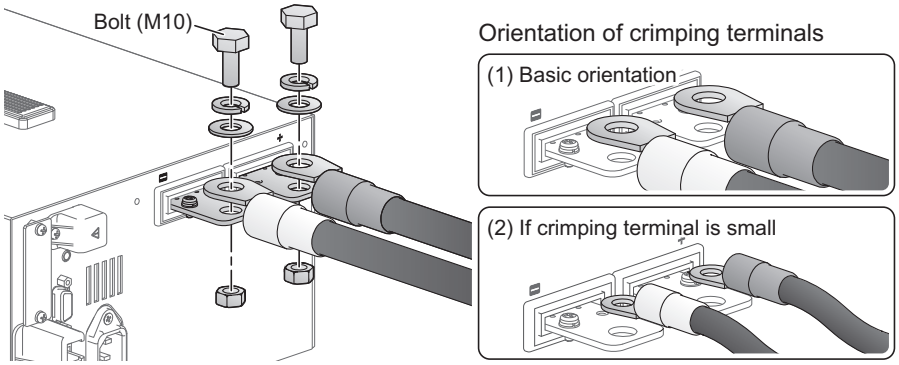
Attaching the load cables

1 **Turn the POWER switch off (○).**

2 **Turn off the output of the DUT.**

3 **Attach crimping terminals to the load cables.**
The load input terminals on the rear panel have bolt (M10) holes for connecting the load cables. Attach the appropriate crimping terminals to the cables.

4 **Connect the load cables to the load input terminals on the rear panel using the included load input terminal screw set.**
To prevent interference with the load input terminal cover, basically connect the crimping terminals in orientation (1) in the figure. If the crimping terminals are small and cannot be connected in orientation (1), connect them in orientation (2).

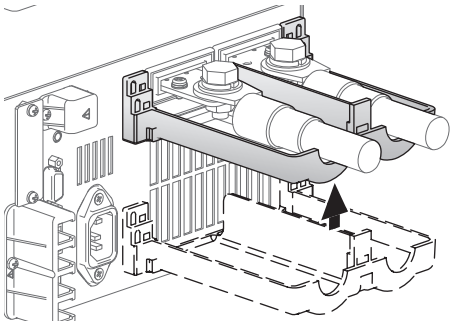


Attaching the load input terminal cover

You can adjust the diameter of the holes that the load cables pass through by changing the positions in which the top and bottom load input terminal covers are put together. There are two available positions. Use the appropriate position for the load cables that you are using.

- For cables up to ø10 mm: Put the top and bottom load input terminal covers together so that the hole diameter is small.
- For cables that are between ø10 and 20 mm: Put the top and bottom load input terminal covers together so that the hole diameter is large.

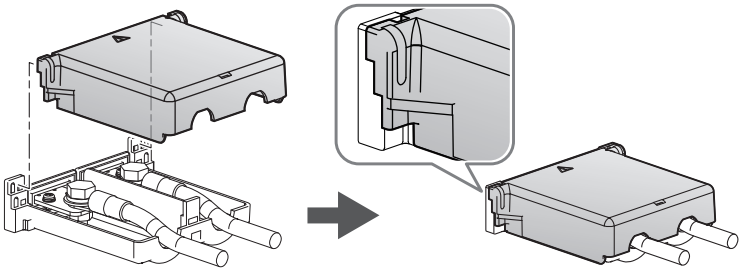
1 **Place the bottom half of the load input terminal cover underneath the cables connected to the load input terminals.**



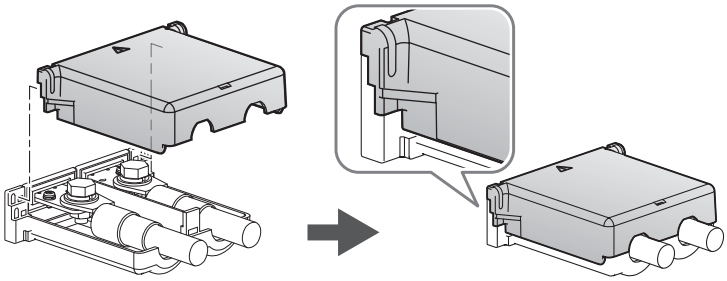
2 **Align the tabs of the top load input terminal cover with those of the bottom cover.**

Align the tabs of the load input terminal cover according to the load cable diameter.

For thin load cables (up to Φ10)

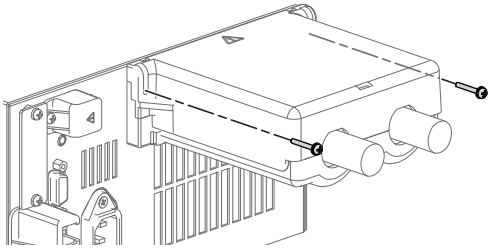


For thick load cables (Φ10 to Φ20)



3 **Push the load input terminal cover against the panel, and fasten it with the included rear-panel load input terminal cover screws.**

Make sure that the screws are securely fastened.



4 **Connect the load cables to the output terminals of the DUT.**
Connect the positive (+) polarity of the load input terminal on the rear panel to the positive (+) polarity of the DUT, and the negative (−) polarity of the load input terminal on the rear panel to the negative (−) polarity of the DUT.

Connecting to the load input terminals on the front panel

The load input terminals on the front panel enable you to easily connect the DUT to the PLZ-5W.

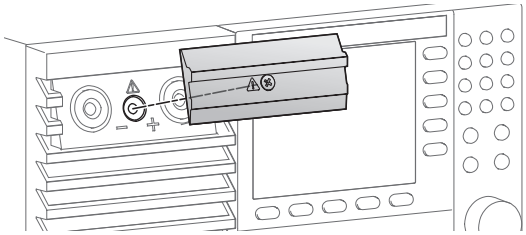
The specifications of the PLZ-5W are for the load input terminals on the rear panel and the load input terminals on the front panel may not meet the specifications.

⚠WARNING
- **Risk of electric shock. Attach insulation caps to the crimping terminals.**
- **The rated current value of the load input terminals on the front panel of the PLZ1205W is 80 A. When a current of 80 A or more flows to the load input terminals on the front panel, an alarm occurs and load off.**

1 **Turn the POWER switch off.**

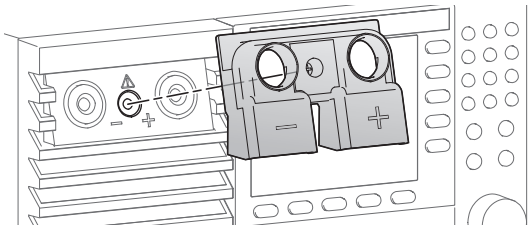
2 **Turn off the output of the DUT.**

3 **Remove the protection plate of the load input terminals on the front panel.**

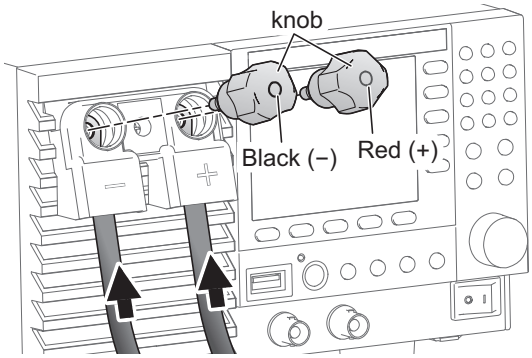


Keep the removed protection plate and screws in a safe place. By attaching the protection plate when not using the load input terminals on the front panel, the PLZ-5W can be used in a safe and compact manner.

4 **Attach the cover for the load input terminals on the front panel.**



5 **Insert the load cables from the bottom and tighten the accessory knobs to fix the cables in place.**

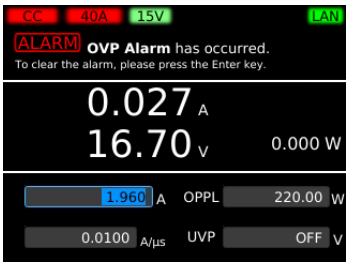


6 **Connect the load cables to the output terminals of the DUT.**
Connect the positive (+) polarity of the load input terminal on the front panel to the positive (+) polarity of the DUT, and the negative (–) polarity of the load input terminal on the front panel to the negative (–) polarity of the DUT.

Notes regarding load input terminals

Do not apply overvoltage to the load input terminals

⚠CAUTION To avoid damaging the product, observe the following precautions. Do not apply a voltage that exceeds 150 Vdc to the load input terminals.

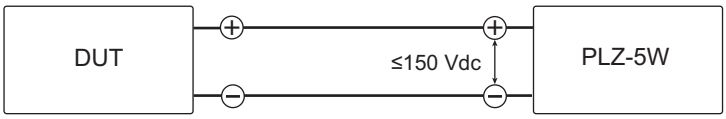


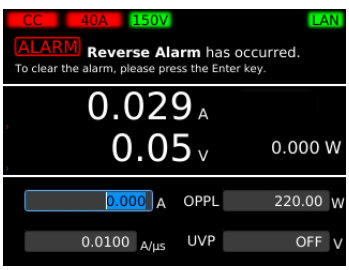
When an overvoltage of 165 V is applied when the voltage range is 150 V, or when an overvoltage of 16.5 V is applied when the voltage range is 15 V, a beeping sound is emitted and an alarm screen appears. In that case, immediately lower the voltage of the DUT.

Match the wiring polarity with that of the DUT

⚠CAUTION Inverting the polarity during connection will cause overcurrent to flow, which may damage the DUT and the PLZ-5W.

Be careful to match the polarities of the load input terminals with those of the DUT during connection.





If a reverse voltage of 0.6 V or higher is applied, or a reverse current (approximately -1% of the range rating) flows, a beeping sound is emitted and an alarm screen appears. In that case, immediately turn off the POWER switch of the DUT.

2 Basic Functions

Panel Operations

The PLZ-5W is controlled from the operation panel on the front panel.

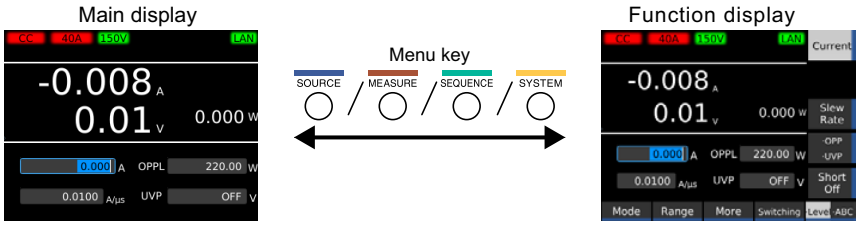
Using the function keys

Switching the display

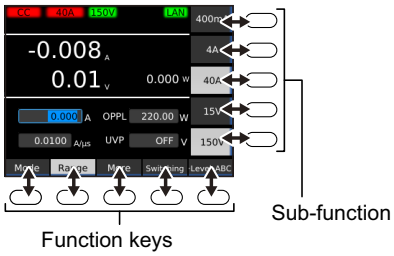
The following two display methods are available.

Display method	Description
Main display	Displays the measurement values and settings in a large size.
Function display	Zooms out of the display of measurement values and settings, and displays a menu allowing execution with function keys/sub-function keys.

Pressing Menu while the main display is displayed switches the display to the function display. Pressing Menu again switches the display to the menu display.



Function keys and sub-function keys

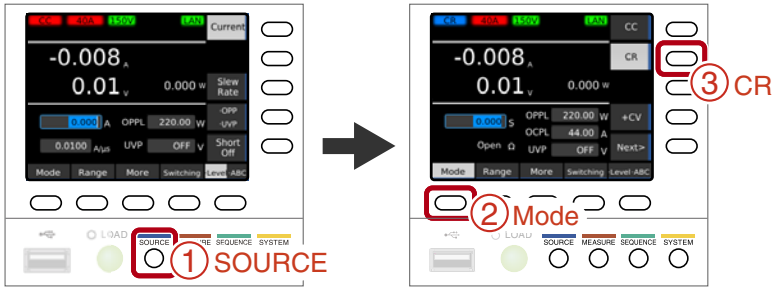


During function display, the functions that are currently available are displayed above the function keys and to the left of the sub-function keys. You can execute the displayed functions by pressing the corresponding function key or sub-function key.

Operation example (Selection of constant resistance mode)

1 Press SOURCE, Mode, and then CR.

In the case of the above procedure, press the buttons in the following order.



Inputting numbers/characters

Front panel

If a cursor appears on the display, you can enter numbers. Depending on the input location, the input of alphabetic characters and symbols may be possible.

Purpose	Operation	Description
Numeric/character input	Numeric keypad	Following input, press ENTER to confirm the input.
	Rotary knob	Turn clockwise to increase the value. Turn counterclockwise to decrease the value. Depending on the input location, the input of alphabetic characters/symbols may be possible by continuing to turn the rotary knob. ENTER need not be pressed following input.
Cursor movement	◀ / ▶ keys	Change in number of digits or input position.
Delete	CLEAR key	Clears the input characters.
Cancel	ESCAPE key	Cancels numeric/character input.

External keyboard

If you connect a keyboard to the USB port to the front panel, you can enter numbers/characters with keys and apply them with the Enter key and move between input parameters with the Tab key.

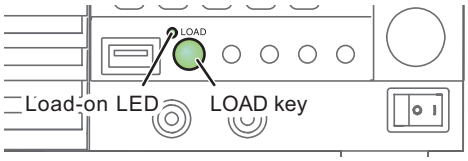
Load On/Load Off

"Load on" refers to a condition in which a current is running through the PLZ-5W. "Turning the load on" refers to the operation of running a current through the PLZ-5W. Conversely, "load off" refers to a condition in which a current is not running through the PLZ-5W. "Turning the load off" refers to the operation of stopping a current from running through the PLZ-5W. Turning the PLZ-5W's load on and off is done with the LOAD key.

1 **Press LOAD.**

The value switches between load on and load off each time you press the key.

In the load on state, the load on LED lights.
In the load off state, the load on LED turns off.



■ Controlling load on/load off externally

Load on/load off can be controlled using an external signal *(p.78)*.

■ Gradually increasing the input current of the PLZ-5W

In constant current (CC) mode, you can set to slowly increase the input current. (Soft start) *(p.43)*.

■ Turning off the load after a specified time elapses

When performing battery or capacitor discharge tests, it is convenient to use the function to automatically turn off the load after a specified time elapses (auto load off timer) *(p.46)*.

Setting the Operation Mode

The following five operation modes are available on the PLZ-5W. Mode switching can be done only while the load is off.

Constant current (CC) mode	A current value is specified and the current is kept constant even when the voltage changes.
Constant resistance (CR) mode	A conductance value is specified and the PLZ-5W sinks current proportional to the voltage variation.
Constant voltage (CV) mode	A voltage is specified and the PLZ-5W sinks current so that the voltage at the load input end of the PLZ-5W is constant.
Constant power (CP) mode	A voltage is specified and the PLZ-5W sinks current so that the power consumed inside the electronic load is constant.
Arbitrary I-V characteristics (ARB) mode	The desired load characteristics can be set by specifying multiple arbitrary voltage values and current values as I-V characteristics.

Setting constant current (CC) mode

In constant current (CC) mode, the current is kept constant even when the voltage changes *(p.115)*.

1 **Press SOURCE, Mode, and then CC.**

"CC" appears in the upper left of the display, and the operation mode is set to CC mode.

2 **Press •Level and then Current.**

3 **Use the numeric keypad or the rotary knob to enter the current value.**

This sets the current value. The current value can be changed even while the load is turned on.

Setting constant resistance (CR) mode

In constant resistance (CR) mode, the PLZ-5W sinks current proportional to the voltage variation *(p.116)*. The resistance calculated from the conductance can also be displayed. (Conductance [S] = 1/resistance [Ω])

1 **Press SOURCE, Mode, and then CR.**

"CR" appears in the upper left of the display, and the operation mode is set to CR mode.

2 **Press •Level and then Conductance.**

3 **Use the numeric keypad or the rotary knob to enter the conductance value.**

This sets the conductance value.
The conductance value can be changed even while the load is turned on.

Setting constant voltage (CV) mode

In constant voltage (CV) mode, the PLZ-5W sinks current so that the voltage at the load input end of the PLZ-5W is constant *(p.119)*.

1 **Press SOURCE, Mode, Next, and then CV.**

"CV" appears in the upper left of the display, and the operation mode is set to CV mode.

2 **Press •Level and then Voltage.**

3 **Use the numeric keypad or the rotary knob to enter the voltage value.**

This sets the voltage value. The voltage value can be changed even while the load is turned on.

Setting constant power (CP) mode

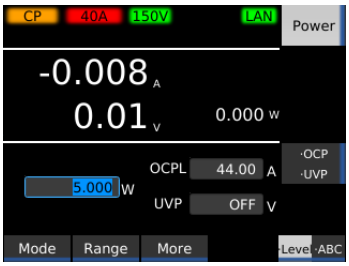
In constant power (CP) mode, the PLZ-5W sinks current so that the power consumed inside the PLZ-5W is constant *(p.118)*.

1 **Press SOURCE, Mode, Next, and then CP.**

"CP" appears in the upper left of the display, and the operation mode is set to CP mode.

2 **Press •Level and then Power.**

3 **Use the numeric keypad or the rotary knob to enter the power value.**



This sets the power value. The power value can be changed even while the load is turned on.

Adding CV mode to CC mode (CC+CV)

Constant voltage (CV) mode can be added while constant current (CC) mode is set *(p.121)*.
CV mode can be added even while the load is turned on.

1 **Set CC mode.**

See “Setting constant current (CC) mode”*(p.21)* to set CC mode.

2 **Press +CV.**

CV mode is added to CC mode and “CC+CV” appears on the display.
Press +CV again to return to the original state.

3 **Press •Level and then Voltage.**

4 **Use the numeric keypad or the rotary knob to enter the voltage value.**

This sets the voltage value.
The voltage value can be changed even while the load is turned on.

Adding CV mode to CR mode (CR+CV)

Constant voltage (CV) mode can be added while constant resistance (CR) mode is set *(p.122)*. CV mode can be added even while the load is turned on.

1 **Set CR mode.**

See “Setting constant resistance (CR) mode”*(p.21)*to set CR mode.

2 **Press +CV.**

CV mode is added to CR mode and “CR+CV” appears on the display.
Press CR+CV again to return to the original state.

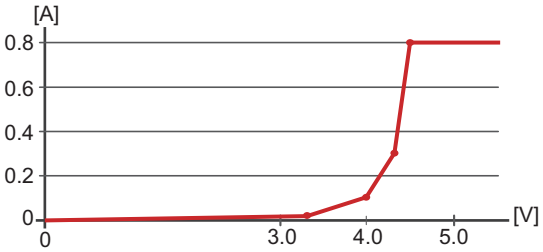
3 **Press •Level and then Voltage.**

4 **Use the numeric keypad or the rotary knob to enter the voltage value.**

This sets the voltage value.
The voltage value can be changed even while the load is turned on.

Setting arbitrary I-V characteristics (ARB) mode

In arbitrary I-V characteristics (ARB) mode, arbitrary I-V characteristics can be set by registering multiple I-V characteristic points (set of voltage value and current value). Three up to 100 points can be registered, and the space between two points is linearly interpolated. This mode can be used for simulation of LED loads and the like.



I-V characteristics example

Example of settings

Voltage [V]	Current [A]
0	0
3.2	0.02
4.0	0.1
4.3	0.3
4.5	0.8
157.5	0.8

1 **Press SOURCE, Mode, Next, and then ARB.**

The ARB mode is set.

Editing I-V characteristics

The I-V characteristics can be edited in ARB mode.

1 **Press •Level and then Table.**

The I-V characteristics editing screen appears.

2 **Select a value with the rotary knob and ◀/▶ keys.**

You can select a row with the rotary knob and use the ◀/▶ keys to change the Voltage and Current.

3 **Edit the I-V characteristics.**

Purpose	Operation
Change a value[1]	Press Table(•Edit), use the numeric keypad or the rotary knob to enter the value, and then press ENTER.
Increment/decrement rows	Press Count, use the numeric keypad or the rotary knob to enter the total number of rows, and then press ENTER.

1 The voltage and current on the first line and the voltage on the last line cannot be changed. For voltage, you cannot enter a value that is less than the value in the previous row.

Repeat step 2 and step 3 to edit the I-V characteristics.

Example: Setting I-V characteristics

You can smoothly set the I-V characteristics by first setting the row with the maximum voltage, and then proceeding to set the other values in decreasing order. As an example, let's set the I-V characteristics while referring to the table on the right.

Example of settings

Voltage [V]	Current [A]
0	0
3.2	0.02
4.0	0.1
4.3	0.3
157.5	0.8

1 Press •Level and then Table.

The I-V characteristics editing screen appears.

2 Press Count, use the numeric keypad or the rotary knob to enter "6", and then press ENTER.

The voltage and current value rows are added.

3 Use the rotary knob to select the 6th row.

4 Use the ▶ key to select the Current row, and then press Table(•Edit).

5 Use the numeric keypad or the rotary knob to enter "0.8", and then press ENTER.

6 Use the rotary knob to select the 5th row

7 Use the ◀ key to select the Voltage row, and then press Table(•Edit).

8 Use the numeric keypad or the rotary knob to enter "4.5", and then press ENTER.

9 Use the ▶ key to select the Current row, and then press Table(•Edit).

10 Use the numeric keypad or the rotary knob to enter "0.8", and then press ENTER.

11 In the same manner, set the voltage and current values on the 4th, 3rd, and 2nd rows.

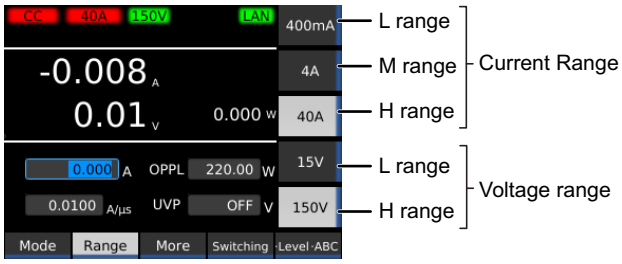
The I-V characteristics are now set.

Setting the Current Range / Voltage Range

The current range and voltage range can be set when the load is off.

1 **Press SOURCE and then Range.**

2 **Use the sub-function keys to set the current range and the voltage range.**



The current range that can be selected varies depending on the model.

This sets the current range and the voltage range.

Setting the Slew Rate

You can set the speed of change when the current is changed.

By setting the slew rate, the slew rate will function in the following cases.

- When the setting is changed to change the current value (including the switching function).
- When the current value is changed using external control in constant current (CC) mode.
- When the current value is changed while the load is on.

The slew rate is set according to the current range as an amount of current change per unit of time. Moreover, a common value is set for the rise and fall speeds.

In CC mode and ARB mode, the slew rate can be set regardless of whether the load is on or off.

NOTE

- The specified slew rate may not be achieved depending on the load cable inductance. If this happens, reduce the load cable inductance *(p.111)*.
- If the load current is small, the specified slew rate may not be achieved *(p.113)*.
- If the current changes when the load is turned on, the slew rate may be slower than the setting.

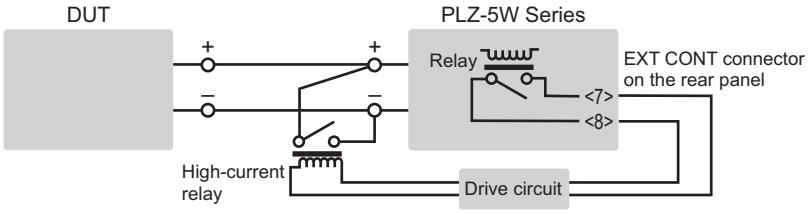
1 **Press SOURCE, •Level, and then Slew Rate.**

2 **Use the numeric keypad or the rotary knob to enter the slew rate value.**

This sets the slew rate.

Setting the Short Function

When the short function is activated, in constant current (CC) mode, the maximum current value, and in constant resistance (CR) mode, the minimum voltage value, is set, and the relay contact (30 Vdc/1 A) of the EXT CONT connector *(p.74)* closes. The load input terminals can be shorted by driving an external high-current relay or the like.



NOTE Be sure to use a dedicated driver circuit to drive the high-current relay. Please provide your own dedicated driver circuit.

The short function is set in CC mode or CR mode.

1 **Press SOURCE and then •Level.**

2 **In CC mode, press Current, and in CR mode, press Conductance.**

3 **Press Short.**

The short function switches on and “Short” appears for the current value.
The short function switches ON and OFF each time you press Short.

Switching Function

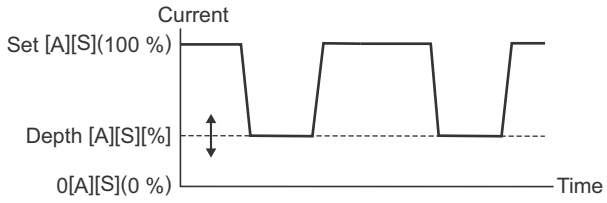
Switching refers to the operation of executing two settings repetitively. The switching function is suitable for transient response characteristics testing of regulated DC power supplies.

The switching function operates in CC mode and CR mode. This function can be set regardless of whether the load is on or off.

When the switching operation is in progress, a trigger signal is output from the TRIG OUT connector on the front panel *(p.31)*.

Setting the switching level

The switching level is set using a current value or conductance value.



Set: Current value through settings of CC mode, CR mode
Depth: Switching level

1 **Press SOURCE, Switching, and then Depth.**

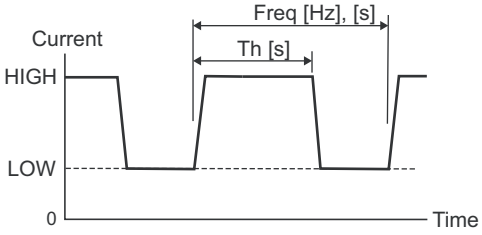
2 **Use the numeric keypad or rotary knob to enter the switching level (Depth).**

In CC mode, enter the current value [A], and in CR mode, enter the conductance value [S]. The input switches between current value/conductance value input and percentage [%] input every time you press Depth. In the case of percentage input, enter a percentage of the value currently set in CC mode/CR mode.

This sets the switching level.

Setting the switching interval

The switching interval can be set using one of two methods, either by using the frequency or the time of one cycle and duty cycle (ratio of HIGH side during 1 cycle), or by using the operation time on the HIGH side.



Freq: Time of one cycle of the switching interval
Th: Switching interval's HIGH side time
Duty cycle: $\frac{\text{Th [s]}}{\text{Freq [s]}}$

Setting the switching interval with the duty ratio

Set the frequency (or the time of one cycle) and duty ratio.

1 **Press SOURCE, Switching, and then Freq or Period.**

The input switches between frequency [Hz] input and 1 cycle's time [s] input every time you press Freq or Period.

2 **Use the numeric keypad or the rotary knob to enter the frequency (1 Hz to 100 kHz) or 1cycle's time (10 µs to 1 s).**

3 **Press Duty.**

4 **Use the numeric keypad or the rotary knob to enter the duty ratio (1 % to 99 %).**

The minimum switching interval is 5 µs.

This sets the switching interval.

Setting the switching interval with the HIGH side operation times

Set the frequency (or the time of one cycle) and the operation time on the HIGH side.

1 **Press SOURCE, Switching, and then Freq or Period.**

The input switches between frequency [Hz] input and 1 cycle's time [s] input every time you press Freq or Period.

2 **Use the numeric keypad or the rotary knob to enter the frequency (1 Hz to 100 kHz) or 1cycle's time (10 µs to 1 s).**

3 **Press Th twice to switch to Th [s] input.**

The input switches between Duty [%] to Th [s] input every time you press Th.

4 **Use the numeric keypad or the rotary knob to enter the HIGH side operation time.**

This sets the switching interval.

Turning the switching function on/off

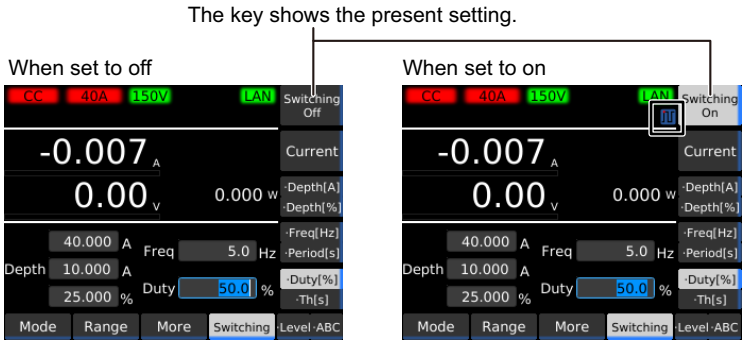
If you want to turn on the switching function, set the switching level *(p.29)* and switching interval *(p.29)* in advance.

1 **Press SOURCE and then Switching.**

2 **Press Switching Off or Switching On.**

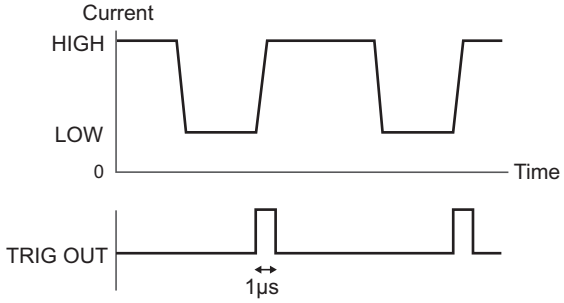
The switching function switches ON and OFF each time you press key.

When the switching function turns on, appears on the display.



Timing of trigger signal output

When the switching operation is in progress, a trigger signal is output for 1 µs from the TRIG OUT connector on the front panel when the current changes from low to high level.



Alarm Function

This function detects anomalies and protects the DUT.

Alarm types and operation

There are two types of alarm based on urgency level: alarm 1 (high urgency) and alarm 2 (low urgency).

Alarm 1 (high urgency)

This alarm detects anomalies and automatically turns off the load. The operating conditions of this alarm are fixed. When alarm 1 occurs, immediately remove the cause(s) of the alarm.

Name	Display	Operating condition	Operation time
Overvoltage detection	OVP Alarm	Voltage that is equal to or exceeds 110% of the maximum voltage of the range is applied to the load input terminals.	Load off
Reverse-connection detection	Reverse Alarm	A reverse voltage (-0.6 V) is applied to the load input terminals. Or, a reverse current (approximately -1% of the range rating) flows.	Load off
Overheat detection[1]	OHP Alarm	The temperature of the internal devices exceeds the standard.	Load off
Alarm input detection[2]	External Alarm	Signal in the 0 V to 1.5 V range is input to the ALARM INPUT (pin 6) of the EXT CONT connector.	Load off
Front-panel load input terminal overcurrent detection	Front Alarm	A current of 80 A or higher flowed through the front panel load input terminals.	Load off
Parallel operation anomaly detection	See the reference.	An anomaly occurred during parallel operation *(p.86)*.	Load off

1 Check whether the air inlet on the front panel and the air outlet on the rear panel are being obstructed.
2 First clear the signal input to the EXT CONT connector, then clear the alarm of the PLZ-5W.

Alarm 2 (low urgency)

This alarm protects the DUT. The operating conditions of this alarm can be set freely within a given range.

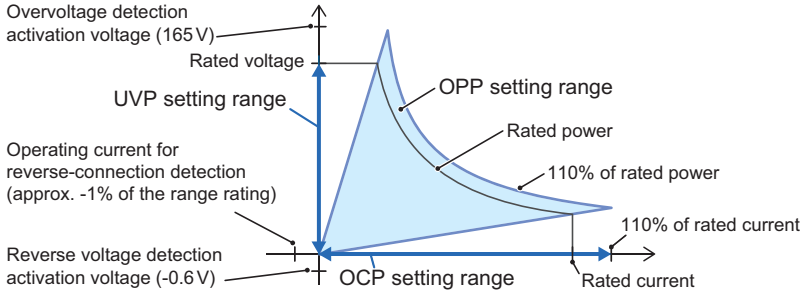
Name	Display	Operating condition	Operation time
Overcurrent protection (OCP)	OCP Alarm	OCP setting (0 % to 110 % of the rated current) or higher flows *(p.33)*.	Select between load off, limit.
Overpower protection (OPP)	OPP Alarm	OPP setting (0 % to 110 % of the rated power) or higher is applied *(p.33)*.	Select between load off, limit.
Undervoltage protection (UVP)[1]	UVP Alarm	The voltage becomes equal to or less than the UVP setting (0 V to 150 V) *(p.34)*.	Load off
Watchdog Protection (WDP)	Watchdog Alarm	SCPI communication is not performed for a length of time that is equal to or exceeds the watchdog protection setting *(p.35)*.	Load off

1 UVP can be set to off.

Operating range

The operating range of the alarms is linked to the current and the voltage ranges.

Memo
The appendix *(p.114)* explains the operation of each operation mode.



NOTE

- The detection points of OCP, OPP, and UVP are the load input terminals of the PLZ-5W. However, when the remote sensing function is used, the detection points are the connection points (sensing points).
- The detection points for overvoltage detection and reverse-connection detection are the load input terminals of the PLZ-5W.

Setting overcurrent protection (OCP)

This function either puts a limit on the current (OCPL) or turns off the load of the PLZ-5W (OCPT) when a current that is equal to or exceeds the set value is running through the PLZ-5W. You can set the overcurrent protection setting and the operation when an alarm occurs.

If the OCP setting is set to 110% of the L range rating or M range rating, an alarm occurs at a current 110% of each range's rating.

OCP is set when the load is off in CR mode, CV mode, and CP mode.

1 **Press Source and then •Level.**

2 **Press •OCP to select OCPL or OCPT.**

Each time you press the key, the selected item changes.

3 **Use the numeric keypad or the rotary knob to enter the current value.**

4 **Press Action and select the operation when an alarm occurs.**

The setting switches each time you press Action.

Item	Description
Trip	Turns the load off. The display changes to "OCPT".
Limit	Limits the current so as not to exceed the set value. The display changes to "OCPL".

This sets the operation when an alarm occurs.

Setting overpower protection (OPP)

This function either puts a limit on the power (OPPL) or turns off the load of the PLZ-5W (OPPT) when a current that is equal to or exceeds the set value is applied to the PLZ-5W. You can set the overpower protection setting and the operation when an alarm occurs.

If the OPP setting is set to 110% of the L range rating or M range rating, an alarm occurs at a power 110% of each range's rating.

OPP can be set when the load is off in operation modes other than CP mode.

1 **Press Source and then •Level.**

2 **Press •OPP to select OPPL or OPPT.**

Each time you press the key, the selected item changes.

3 **Use the numeric keypad or the rotary knob to enter the power value.**

4 **Press Action and select the operation when an alarm occurs.**

The setting switches each time you press Action.

Item	Description
Trip	Turns the load off. The display changes to “OPPT”.
Limit	Limits the current so as not to exceed the set value. The display changes to “OPPL”.

This sets the operation when an alarm occurs.

Setting undervoltage protection (UVP)

This function turns off the load of the PLZ-5W when the voltage applied to the PLZ-5W becomes equal to or less than the UVP setting. You can also disable UVP.

UVP can be set when the load is off in operation modes other than CV mode.

Setting the undervoltage protection value

1 **Press Source and then •Level.**

2 **Press •UVP to select UVP.**

Each time you press the key, the selected item changes.

3 **Use the numeric keypad or the rotary knob to enter the voltage value.**

This sets the UVP value.

Turning undervoltage protection off

1 **Press Source and then •Level.**

2 **Press •UVP to select UVP.**

Each time you press the key, the selected item changes.

3 **Turn the rotary knob counterclockwise to set the voltage value to OFF.**

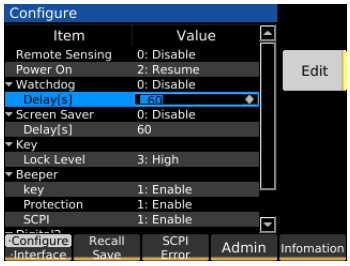
UVP is turned off.

Setting watchdog protection (WDP)

This function turns off the load of the PLZ-5W when SCPI communication is performed for a length of time that is equal to or exceeds the WDP setting.

1 **Press SYSTEM.**
If the Configure screen does not appear, press Configure.

2 **Use the rotary knob to select Delay under Watchdog, and then press Edit.**



3 **Use the numeric keypad or the rotary knob to enter the time [s], and then press ENTER.**
This sets the WDP value.

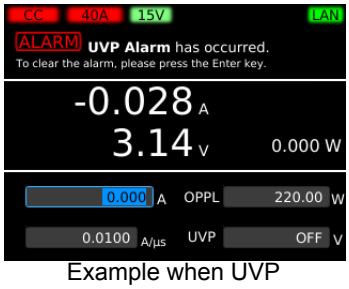
4 **Use the rotary knob to select Watchdog, and then press Edit.**

5 **Use the rotary knob to select Enable, and then press ENTER.**
WDP is enabled. Selecting Disable disables WDP.

When an alarm occurs

An alarm message appears in the message area of the display.
Additionally, there are the following status outputs to the EXT CONT connector.

- When overvoltage detection, reverse-connection detection, overheat detection, alarm input detection, front-panel load terminal overcurrent detection or parallel operation anomaly detection is activated: ALARM1 (pin 14) switches ON
- When OCP, OPP, UVP or WDP is activated: ALARM2 (pin 15) switches ON



Example when UVP

Clearing an alarm

1 **Remove the cause of the alarm.**

2 **Either press ENTER or input a signal in the 3.5 V to 5.0 V range to ALARM CLEAR (pin 5) of the EXT CONT connector.**
The alarm is cleared.

NOTE
- If the cause of the alarm remains, the alarm will occur again.

Measurement Function

Overview of the measurement function

The PLZ-5W shows the latest measured values (current, voltage, power) on the display. It can also store them in the internal memory (data logging function).

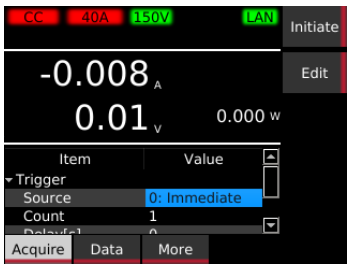
Recorded measurement values are obtained by remote control.

By setting triggers *(p.37)*, you can also control the timing that measurement values are recorded.

The recording timing of measured values can be synchronized on synchronized PLZ-5Ws *(p.55)*.

Starting/stopping measurement

1 **Press MEASURE and then Acquire.**



2 **Press Initiate or Abort.**

Purpose	Step
Start measurement	Press Initiate.
Stop measurement	Press Abort.

While measured values are being recorded, appears on the display.

By factory default, the measurement value is acquired immediately after Initiate is pressed.

Obtaining the measurement data

Recorded measurement values are obtained by remote control. For details, see “Command (function search)” > “Measurement function” in the Communication Interface Manual on the included CD-ROM.

Setting triggers

By setting triggers, you can control the number of times that measurement values are to be acquired, the acquisition timing, and so on. Moreover, you can also change the events that constitute the conditions for measurement value acquisition (trigger sources).

1 **Press MEASURE and then Acquire.**

2 **Use the rotary knob to select the item, and then press Edit.**

Item	Setting	Description
Trigger	–	Sets the trigger.
Source	Immediate/ BUS/DIGITAL2/ MSync/TALink	Sets the trigger source. For detailed, see “Selecting the trigger source” below.
Count	1 to 65536	Sets the number of times measurement values are to be acquired when a trigger is applied.
Delay	0 to 100	Sets the delay time (s) from trigger application until measurement value acquisition.
Interval	Disable/Enable	Sets whether to measure at intervals when Count is 2 or higher.
Interval Time	0.0002 to 3600	If Interval is set to Enable, set the measurement interval time (s).
Sense Aperture	0.0002 to 1	Sets the time (s) required for measurement value acquisition.

3 **Use the rotary knob or numeric keys to perform input, and then press ENTER.**

Repeat steps 2 and 3 to set triggers.

■ Selecting the trigger source

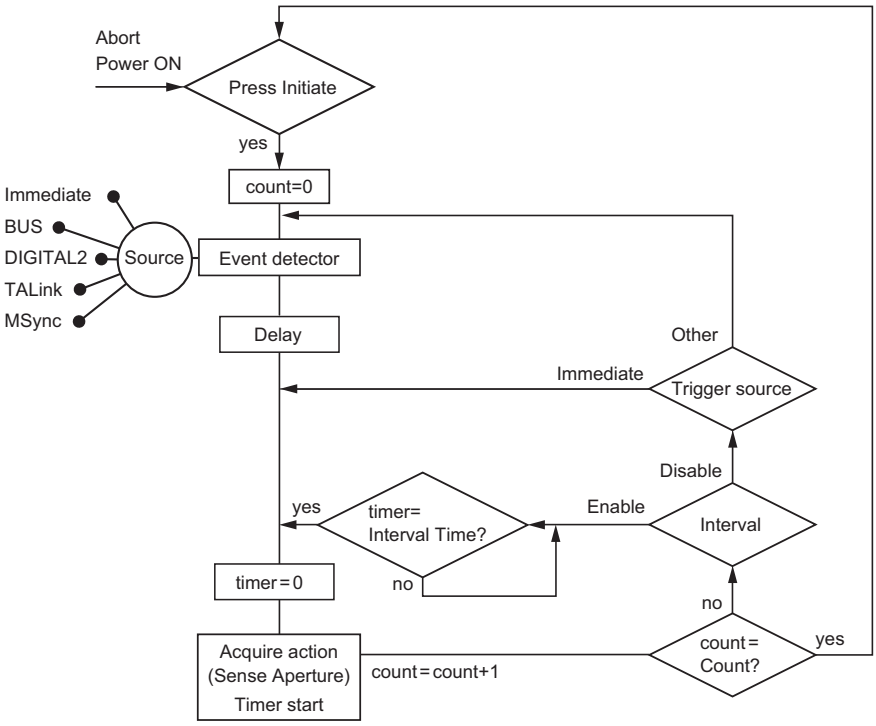
Pressing Initiate causes the PLZ-5W to enter a trigger-wait state. When a trigger selected with Source occurs, the trigger-wait is cleared, and measurement starts. *(p.38)*

Trigger source	Description
Immediate	Immediately acquires the measurement values when Initiate is pressed, without waiting for trigger application.
BUS	Acquires the measurement values when the *TRG command is transmitted from a PC or the like.
DIGITAL2[1]	Acquires the measurement values through signal input to pin 13 of the EXT CONT connector.
MSYNc	The recording timing of measured values can be synchronized on synchronized PLZ-5Ws *(p.55)*.
TALink	Records measurement values when a step is executed if Generate is set to TALink in the sequence step settings *(p.63)*.

1 Only when Direction of Digital 2 is set to Input *(p.90)*.

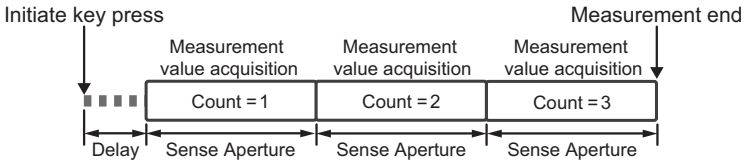
■ Trigger processing procedure

The general trigger processing procedure is illustrated in the following figures.

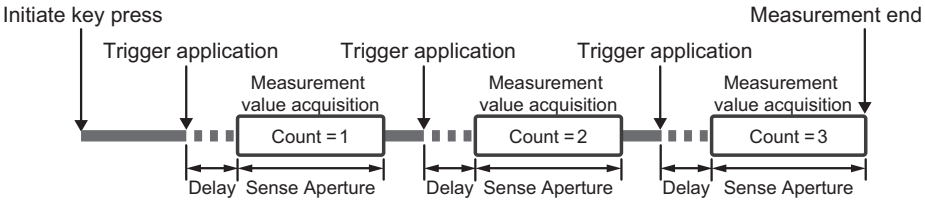


■ Trigger application examples

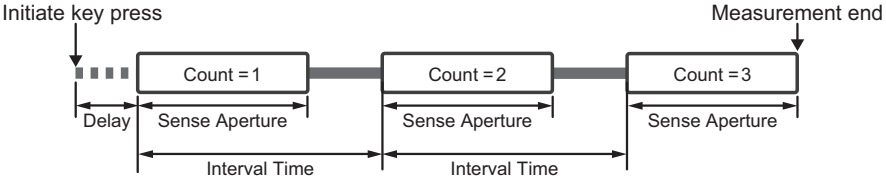
Example: Immediate is set for Source, Interval to Disable, and measurement value acquisition is repeated three times.



Example: BUS/DIGITAL2/TALink/MSync is set for Source, Interval to Disable, measurement result acquisition is repeated three times.



Example: Source is set to Immediate, Interval to Enable, and Count to 3.

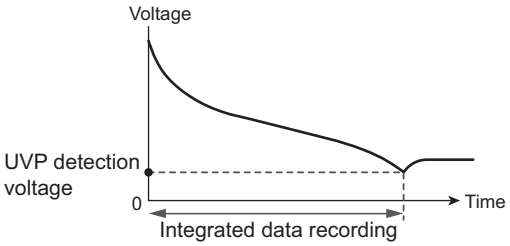


Recording Integrated Data

Recording current capacity/power capacity/elapsed time

Current capacity, power capacity, and elapsed time (hereafter, integrated data) starts/stops being recorded in synchronization with load on/off in the factory default condition. Moreover, at the start of recording, the data is automatically reset. You can change the integrated data recording method, selecting for example manual recording start/stop/reset.

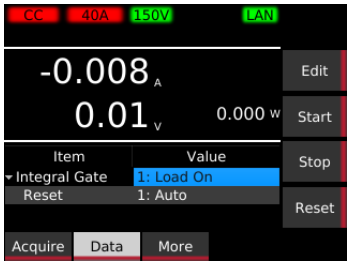
Example: “Integral Gate” is set to “Load On”, and UVP is set



Setting the integrated data recording method

1 **Press MEASURE and then Data.**

2 **Use the rotary knob to select the item, and then press Edit.**



Item	Description
Integral Gate	Sets the integrated data recording period. None: No period is set. Recording is started/stopped with the Start and Stop key. Load On: Integrated data recording is started/stopped in synchronization with load on/load off. Program Run: Integrated data recording is started/stopped in synchronization with sequence execution start/stop.
Reset	Selects the integrated data reset method. Manual: Resets the integrated data when Reset is pressed. Auto: Automatically resets the integrated data before the start of recording. Regardless of the settings above, integrated data will be reset if the PLZ-5W is restarted, the operation mode is changed, or the range is changed.

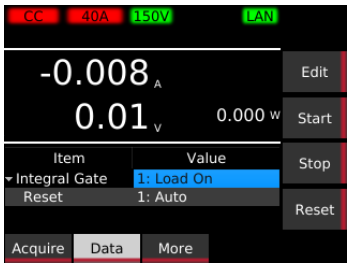
3 **Use the rotary knob to select the value, and then press ENTER.**

This sets the integrated data recording method.

Recording integrated data manually

In the integrated data recording method, if “Integral Gate” is set to “None”, the integrated data can be recorded manually.

1 **Press MEASURE and then Data.**



2 **Press Start.**

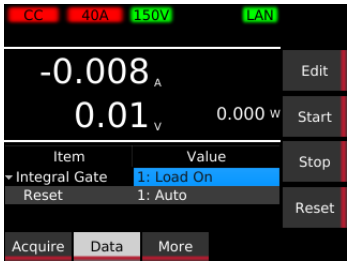
Integrated data recording starts.

3 **Press Stop.**

Integrated data recording stops.

Resetting integrated data manually

1 **Press MEASURE and then Data.**



2 **Press Reset.**

This resets the integrated data.

Displaying the integrated data

You can show the integrated data on the display. This is useful for example for battery discharge tests. By factory default, the integrated data is not displayed.

1 **Press MEASURE and then More.**

2 **Use the rotary knob to select the item, and then press Edit.**

Item	Description
Elapsed Time	Shows the elapsed time.
Capacity	Shows the current capacity (Ah).
Energy	Shows the power capacity (Wh).

3 **Use the rotary knob to select Enable, and then press ENTER.**

The integrated data will now be shown on the display.

3 Advanced Functions

Changing the Response Speed

Set the response speed for the constant voltage (CV) mode or constant resistance (CR) mode according to the conditions and purpose of use of the DUT.
The factory default setting is “Normal”. You can make the response speed faster by setting “Fast”.

NOTE

- When the response speed is set to Fast, the operation may become unstable if the load cable is long or has a large loop. In that case, set the response speed to Normal.

1 **Press SOURCE and then More.**

2 **Use the rotary knob to select the following items under Response, and then press Edit.**

Item	Description
Voltage	Sets the response speed in CV mode.
Conductance	Sets the response speed in CR mode.

3 **Use the rotary knob to select Normal/Fast, and then press ENTER.**

This sets the response speed.

Soft Start

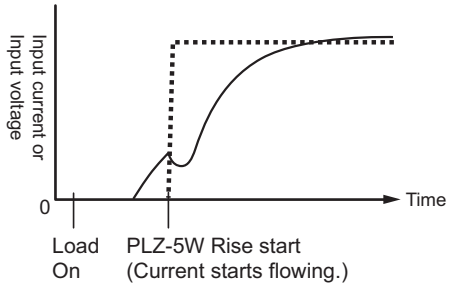
Soft start is a function that controls the rise time of the load current.

Soft start functions only when all the following conditions are met.

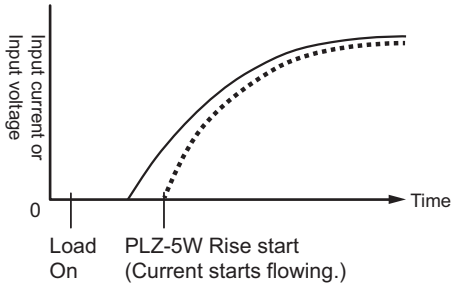
- The rise time of the soft start has been set.
- Load on state in constant current (CC) mode.
- There is an input that is equal to or exceeds the minimum operating condition, from the state where there is no input to the load input terminals.

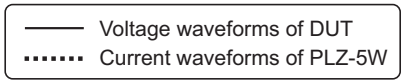
This function is used if the output of the DUT becomes unstable when the load current rises sharply, or when wishing to delay only the current change at startup to prevent the overcurrent protection circuit of the power supply from getting activated.

■ When soft start has been disabled



■ When soft start has been set properly





For the conditions for the current to flow through the PLZ-5W, see “Operating Area” *(p.114)*.

The rise time can be set to OFF/100 µs/200 µs/500 µs/1 ms/2 ms/5 ms/10 ms/20 ms.

1 **Press SOURCE and then More.**

2 **Use the rotary knob to select Soft Start, and then press Edit.**

3 **Use the rotary knob to select the soft start time, and then press ENTER.**

Can be set to OFF/100 µs/200 µs/500 µs/1 ms/2 ms/5 ms/10 ms/20 ms.

This sets the soft start time.

Selecting OFF disables soft start.

Remote Sensing

A voltage measurement point can be changed from a load input terminal to an arbitrary sensing point by executing remote sensing. By setting sensing points to a DUT end, influences such as voltage drops caused by the resistance of the load cables can be reduced and the load current can be stabilized.
To use remote sensing, connect the sensing cables to the sensing connectors of the PLZ-5W and the DUT end, and enable the remote sensing function.

Connecting the sensing cables

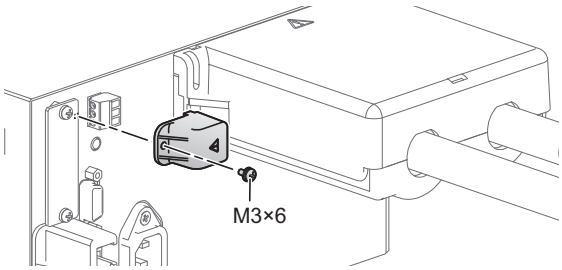
⚠ CAUTION

- Risk of damage to the internal circuitry. Never wire the sensing connectors while the POWER switch is turned on.
- If the remote sensing cables come loose while remote sensing is in use, the PLZ-5W and DUT may be damaged. Be sure to connect the cables securely.

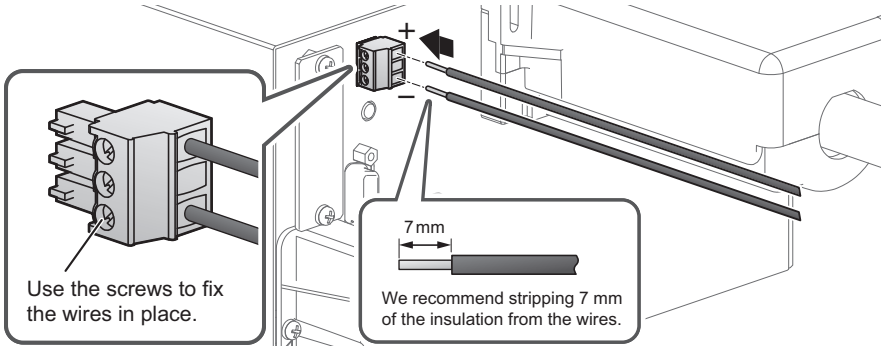
Unlike the load cables, there is no need to consider the current capacity for the sensing cables. However, for adequate mechanical strength, use wires whose nominal cross-sectional area is 0.5 mm^2 or greater.

1 **Turn the POWER switch off.**

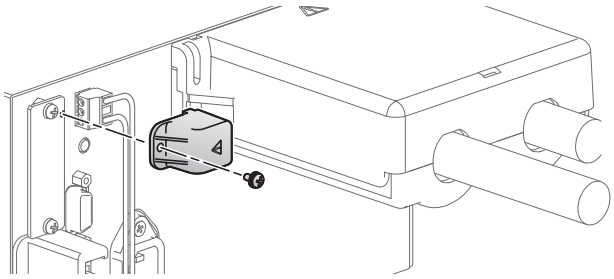
2 **Remove the sensing connector cover on the rear panel.**



3 **Connect the sensing cables to the PLZ-5W.**

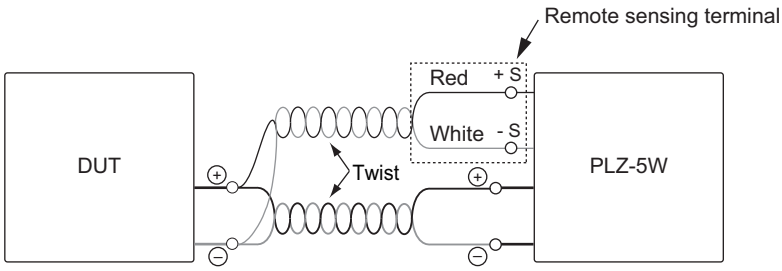


4 **Attach the sensing connector cover.**



5 **Connect the sensing cables to the DUT.**

Connect the positive (+S) polarity of the SENSING connector to the positive (+) polarity of the DUT, and connect the negative (-S) polarity of the SENSING connector to the negative (−) polarity of the DUT. Connect the cables as close to the EUT as possible.



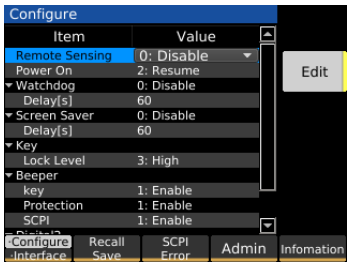
Enabling remote sensing

After connecting the sensing cables, enable the remote sensing function. Remote sensing can be set when the load is turned off and sequence operation is stopped.

1 **Press SYSTEM.**

If the Configure screen does not appear, press Configure.

2 **Use the rotary knob to select Remote Sensing, and then press Edit.**



3 **Use the rotary knob to select Enable, and then press ENTER.**

This enables remote sensing and appears on the display.

Selecting Disable disables remote sensing.

Trigger Function

The PLZ-5W allows you to control the start timing of measurement, sequences and step using triggers. By enabling the trigger function, a measurement or a sequence can be started when an event selected beforehand (trigger source) matches an event either inside or outside the PLZ-5W (trigger).

■ Types of trigger sources

The following trigger sources are supported.
For the setup procedure, see the page describing the target feature.

Trigger source	Description	Applicable function
Immediate	Execution starts at the internal timing of the PLZ-5W without waiting for the trigger signal. The delay until the start of execution is reduced to a minimum.	Measurement *(p.37)* Step execution *(p.63)* Sequence execution *(p.70)*
BUS	Execution starts at the software trigger application timing.	Measurement *(p.37)* Step execution *(p.63)* Sequence execution *(p.70)*
DIGITAL2[1]	Execution starts at the timing at which a signal is input to pin 13 of the ENT CONT connector.	Measurement *(p.37)* Step execution *(p.63)* Sequence execution *(p.70)*
TALink	In the sequence step settings, if Generate is set to TA Link, measurement is performed at the step execution timing.	Measurement *(p.37)*
MSync	Execution starts at the timing at which a signal is input from external equipment synchronized *(p.53)* with the PLZ-5W.	Measurement *(p.37)* Step execution *(p.63)* Sequence execution *(p.70)*
Trig IN	The next step is executed when a signal is input to pin 9 of the EXT CONT connector.	Step execution *(p.63)*

1 Only when Direction of Digital 2 is set to Input *(p.90)*.

Auto Load Off Timer

The auto load off timer automatically turns off the load after a specified time elapses from discharge start of the DUT.

NOTE There is a ±1 second error between the elapsed time recording *(p.39)* and elapsed time display *(p.41)*.

1 Press SOURCE and then More.

2 Use the rotary knob to select Load Off Timer, and then press Edit.

3 Use the numeric keypad or the rotary knob to set the time (s) until load off.

This sets the auto load off timer.

Setting it to OFF turns off the auto load off timer.

Types of Memory

The PLZ-5W has two types of memory, ABC preset memories and setup memory.

■ ABC preset memories

Basic settings (current, voltage, conductance, power) can be saved to three memories, A, B, and C. Because you can recall saved settings just by pressing a key, this feature is very useful when you want to switch between three different types of output in order.

■ Setup memory

You can use setup memory to save all of the basic settings. You can recall memory content when load is turned off. Check the recalled memory content on the screen, and turn load on again.

■ Differences between ABC preset memories and setup memory

Item	ABC preset memories	Setup Memory
Number of memory entries	3	20
Memory name	A, B, C	0 to 19
Saved setting	Basic settings of each operation mode (current, voltage, conductance, power)	Operation mode Basic settings (current, voltage, conductance, power) Current Range / Voltage Range Slew rate Switching level Switching interval Protection function activation point ABC preset memories
When load is on	Memory entries can be saved or recalled.	Memory entries can be saved but not recalled.
When load is off	Memory entries can be saved or recalled.	Memory entries can be saved or recalled.

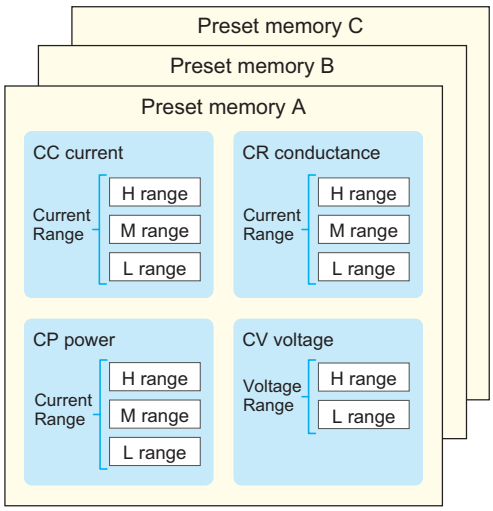
ABC Preset Memories

Load settings can be saved to three memories, A, B, and C.

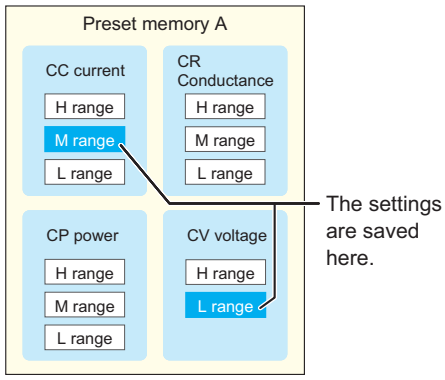
In CC mode, CR mode, CP mode, the load settings for each current range can be saved.
In CV mode, the load settings for each voltage range can be saved.

In ARB mode, you can save the number of Table rows and load settings.

When CV+CC, settings are saved to the memories for CC mode and CV mode.
When CV+CR, settings are saved to the memories for CR mode and CV mode.



For example, if the load settings of CC+CV (current: M range, voltage: L range) are saved to preset memory A.



The basic settings for each operation mode saved to the memories are as follows.

Operation mode	Basic setting
CC mode	Current
CR mode	Conductance
CP mode	Power
CV mode	Voltage
CV+CC	Current, voltage
CV+CR	Conductance, voltage
ARB mode	Number of table rows, voltage, current

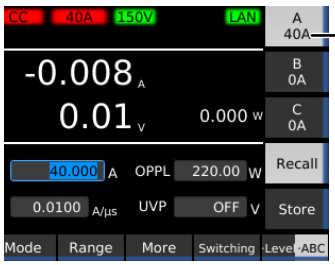
Saving to ABC preset memories

You can save settings regardless of whether the load is on or off. Alarm detection points are not saved.

1 **Enter the load settings for the operation mode and range to be saved.**

2 **Press SOURCE, •ABC (twice), and then Store.**

3 **Press the sub-function keys to select the memory (A, B, C) where you want to save the settings, and then press ENTER.**
The settings are saved to the selected memory.
If setting have already been saved, they are overwritten.



The saved load setting is displayed. (Except the ARB mode.)

Example: CC mode, saved to memory A.

Recalling ABC preset memory entries

You can recall settings regardless of whether the load is on or off.

NOTE

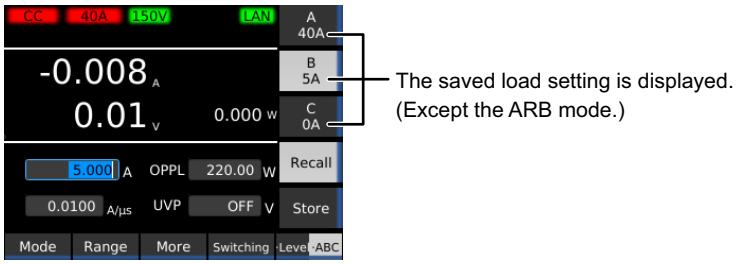
- Alarm detection points are not saved to ABC preset memories. If the settings that you recall cause alarm detection points to be exceeded, an alarm will occur.

1 Sets the operation mode and range.

2 Press SOURCE, •ABC (twice), and then Recall.

3 Press the sub-function key for the memory to be recalled.

The load setting changes accordingly.



Example: CC mode

Setup Memory

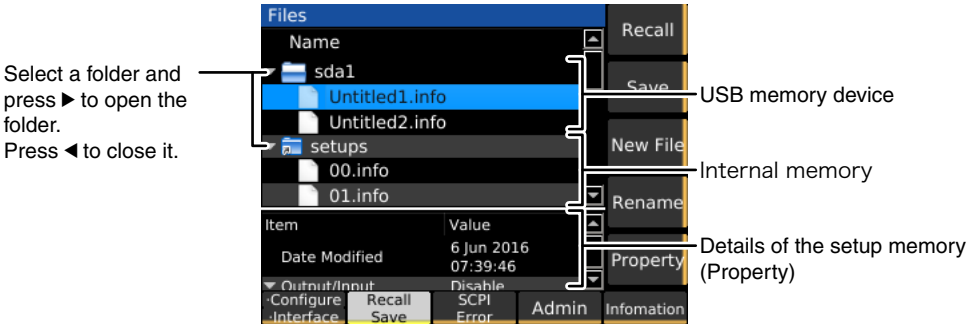
The setup memory can store up to 20 sets (0 to 19) of the current conditions of the items listed below. The current conditions can also be saved in a USB memory device.

- Operation mode
- Load settings (current, conductance, voltage, power)
- Current range setting
- Voltage range setting
- Slew rate
- Switching level (current value/conductance value, or percentage)
- Switching interval (frequency/time of one cycle and duty cycle/operating time on the high side.)
- Alarm detection point
- Content of ABC preset memories

How to view the setup memory edit screen

Press SYSTEM and then Recall Save to display the setup memory edit screen.

Connecting a USB memory device to the USB port on the front panel displays an “sdxx” folder (the “xx” changes depending on the USB memory device) enabling you to save and recall the setup memory from the USB memory device.

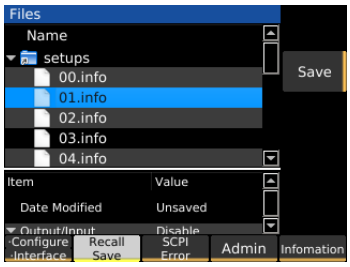


Saving to the setup memory

Saving over a file

1 **Set the operation mode, range, and settings to be saved.**

2 **Press SYSTEM and then Recall Save.**



3 **Use the rotary knob to select the setup memory.**

4 **Press Save.**

The setting contents are saved to the setup memory.

Saving to a new file (USB memory device only)

1 **Set the operation mode, range, and settings to be saved.**

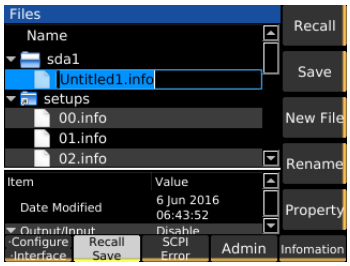
2 **Press SYSTEM and then Recall Save.**

3 **Insert a USB memory device into the USB port on the front panel.**

An “sdxx” folder is displayed. The “xx” changes depending on the USB memory device.

4 **Use the rotary knob to select the sdxx folder, and press New File.**

A new setup memory is created.



5 **Enter a file name, and press ENTER.**

The setup memory is saved.

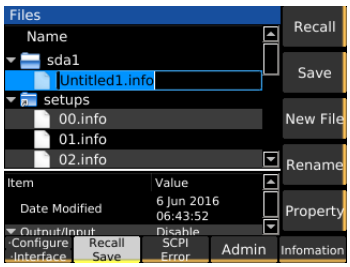
Changing the memory name (USB memory device only)

1 **Press SYSTEM and then Recall Save.**

2 **Insert a USB memory device into the USB port on the front panel.**

An “sdxx” folder is displayed. The “xx” changes depending on the USB memory device.

3 **Use the rotary knob to select the setup memory, and press Rename.**



4 **Enter a file name, and press ENTER.**

The memory name is saved.

Recalling the setup memory

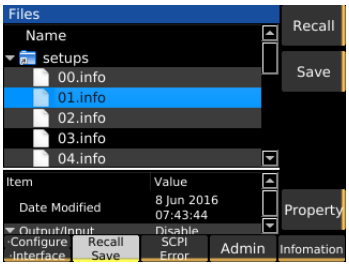
You can recall memory content when load is turned off.

1 **Press SYSTEM and then Recall Save.**

2 **Use the rotary knob to select the setup memory.**

Press Property to view the details of the setup memory.

3 **Press Recall.**



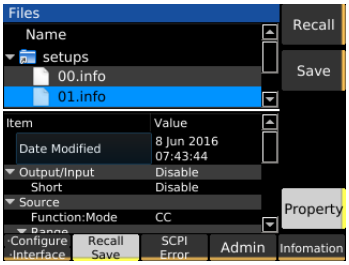
The setting content of the setup memory is recalled.

Checking the setup memory details

1 **Press SYSTEM and then Recall Save.**

2 **Use the rotary knob to select the setup memory.**

3 **Press Property.**



The detailed information of the setup memory is displayed.
The detailed information can be scrolled by using the rotary knob.

Press Property again to return to the original state.

Synchronized Operation

The following synchronization features can be used by simply connecting the PLZ-5W and other equipment to be synchronized with a communication cable.

- Turning the load on/off simultaneously for multiple equipment units.
- Synchronizing measurements (remote control).
- Synchronizing the sequence start timing and resume timing across multiple units.

You can interconnect different PLZ-5W models (for example, PLZ205W and PLZ1205W). Synchronized operation is possible even during parallel operation.

■ Simple setting using LAN cable

A common LAN cable (straight-through) up to 30 m long or the optional parallel operation single cable *(p.133)* can be used as the connection cable. To use a LAN cable more than 30 m long, please contact your Kikusui agent or distributor.

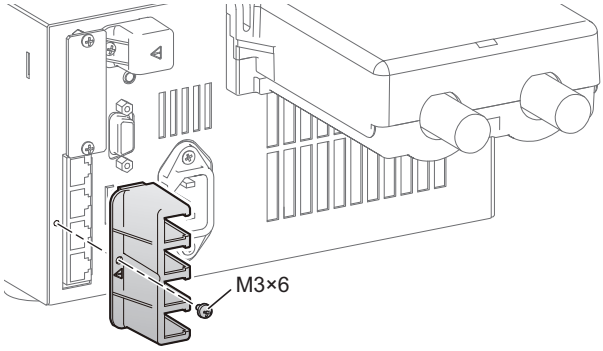
⚠WARNING **Risk of electric shock.**

- **Do not touch the IN/OUT connectors of EXT SYNC while the PLZ-5W is turned ON.**
- **Do not leave one end of the LAN cable unconnected while the other end is connected to the EXT SYNC connector.**

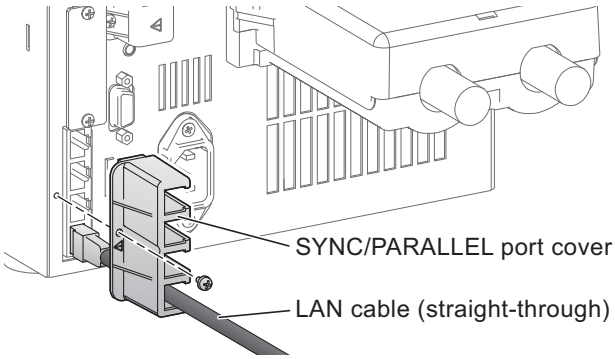
Connection for synchronized operation

1 **Turn the POWER switches of all the PLZ-5W units that you will connect.**

2 **Remove the SYNC/PARALLEL port cover on the rear panel.**



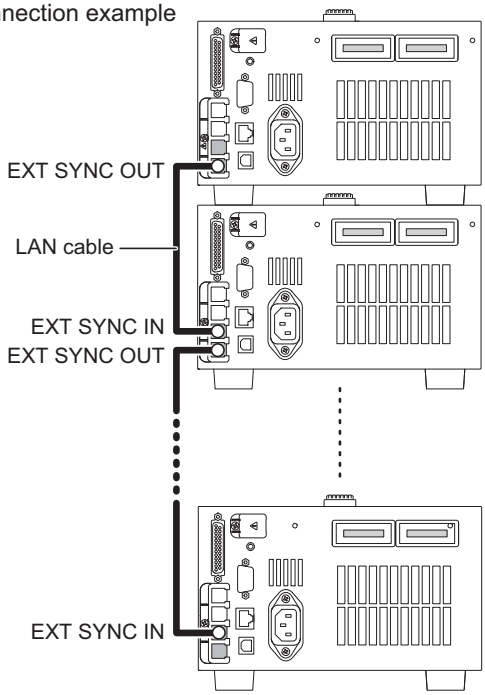
3 **Connect a LAN cable to the OUT port of EXT SYNC, and attach the SYNC/PARALLEL port cover.**



4 **Connect all the PLZ-5W units with LAN cables.**

Connect the OUT port of EXT SYNC of a PLZ-5W unit to the IN port of EXT SYNC of another unit with a LAN cable. After performing the connection, be sure to attach the SYNC/PARALLEL port cover while referring to step 3.

Connection example



This completes connection procedure.

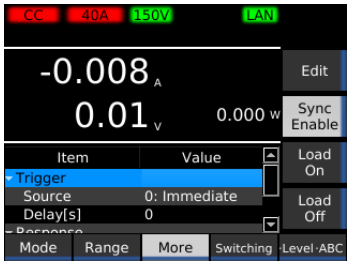
Synchronizing the load on/off operation

You can synchronize the load on/off operation on multiple synchronized PLZ-5Ws *(p.53)*.

1 **Press SOURCE and then More.**

2 **Press Sync Enable.**

Load on/off synchronization switches between enabled and disabled each time you press Sync Enable. When load on/off synchronization is enabled, “Load On” and “Load Off” appear in the sub-function area.



3 **Perform step 1 and step 2 on all PLZ-5Ws to be synchronized.**

4 **Press Load On or Load Off on any of the synchronized PLZ-5Ws.**

The load on/off operation will be synchronized among all PLZ-5Ws whose load on/off synchronization was enabled.

Synchronizing measurements

The recording timing of measured values can be synchronized on multiple synchronized PLA-5Ws *(p.53)*. To synchronize, you need to enter a command through remote control.

1. **Press MEASURE and then Acquire.**
2. **Use the rotary knob to select Source, and then press Edit.**
3. **Use the rotary knob to select MSync, and then press ENTER.**

4. **Press Initiate.**
5. **Perform step 1 and step 4 on all PLZ-5Ws to be synchronized.**
6. **Apply TRIG:ACQ:MSYN commands to synchronized PLZ-5Ws through remote control.**

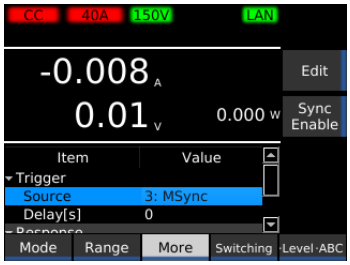
   Measurement starts simultaneously on all synchronized PLZ-5Ws.

   For details, see “TRIG:ACQ:MSYN” in the Communication Interface Manual on the included CD-ROM.

Synchronizing the start of sequences

The sequence start timing can be synchronized on multiple synchronized PLZ-5Ws *(p.53)*.

1. **Press SOURCE and then More.**
2. **Use the rotary knob to select Source, and then press Edit.**
3. **Use the rotary knob to select MSync, and then press ENTER.**



4. **Executing a sequence** *(p.69)*.
5. **Perform step 1 and step 4 on all PLZ-5Ws to be synchronized.**
6. **Press SEQUENCE, Transient, and then MSync on any of the synchronized PLZ-5Ws.**

   Sequence starts simultaneously on all synchronized PLZ-5Ws.

Synchronizing the resuming of sequences

The sequence pause (trigger wait) timing can be synchronized on multiple synchronized PLZ-5Ws *(p.53)*.

1 **Create a program *(p.59)*.**

2 **Create steps, and set Wait(pre) in the step to be paused to MSync *(p.63)*.**

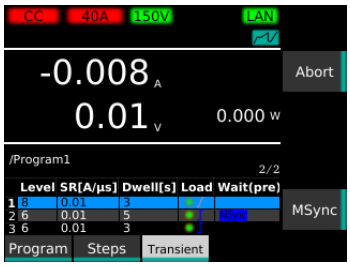
3 **Perform step 1 and step 2 on all PLZ-5Ws to be synchronized.**

4 **Press Transient and then Initiate on all PLZ-5Ws to be synchronized.**

The sequence is executed.

5 **Wait for the sequence on all synchronized PLZ-5W to be paused.**

Before executing the step in which wait(pre) was set to MSync, the sequence is paused (trigger wait), and the sub-function area shows “MSync.”



6 **Press MSync on any of the synchronized PLZ-5Ws.**

Sequence resumes simultaneously on all synchronized PLZ-5Ws.

Remote Control

In addition to using the front panel, you can also control the PLZ-5W remotely by sending commands. For details on remote control, see the Communication Interface Manual on the included CD-ROM.

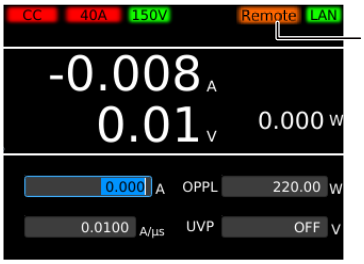
The following environment is required to view the Communication Interface Manual.

Browser: Internet Explorer 11 or later

PDF reader: Adobe Reader 10 or later

Releasing remote control

You can return the PLZ-5W control from remote control (PLZ-5W panel control not accepted) to local control (panel control accepted). While remote control is in progress, the remote icon appears on the display.



Remote icon

1 **Press LOCAL.**

This switches the operation from remote operation to local operation.

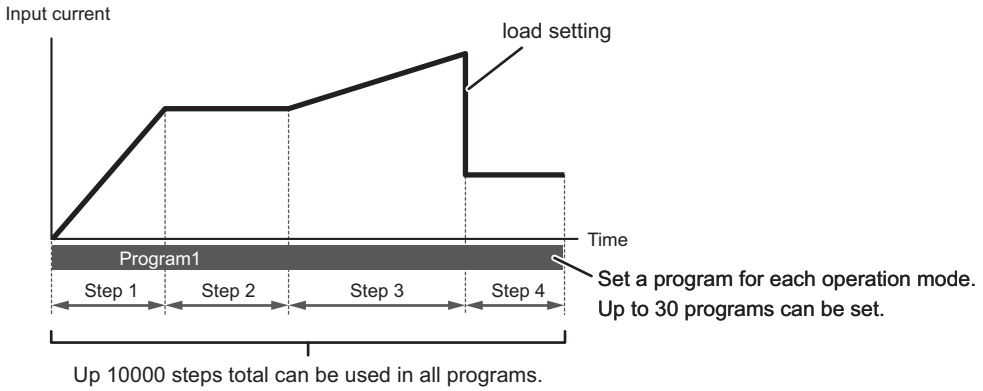
4 Sequence Function

Overview of the Sequence Function

Sequence is a function that executes a sequence of operations set in advance.

Programs and steps

A sequence consists of programs and steps. A program is a collection of steps. Steps are executed in order one at a time, starting from step 1. Upon completion of the last step of a program, execution of that program has been completed once.



Main features

Setting range	Setting item	Description
By step	Load setting	Current, conductance, voltage, power. The values that can be set depend on the current operation mode.
	Slew Rate	Varies depending on the current range setting.
	Step execution time	0.000025 s to 3600000 s
	Load on/off control	To turn the load on, set the load setting transition method to step or ramp.
	Sequence editing/ execution/stop method	Front panel operation or remote operation via RS232C/LAN/USB.
	Miscellaneous	Trigger signal setting, trigger signal output.
By program	Number of loops of program	1 to 100000 repetitions, or infinite repetitions.
	CV mode addition	Specifies the voltage for CV mode addition (+CV).
	Protection function	Specifies the value at which a protection function (OCP, OPP, UVP) is activated.

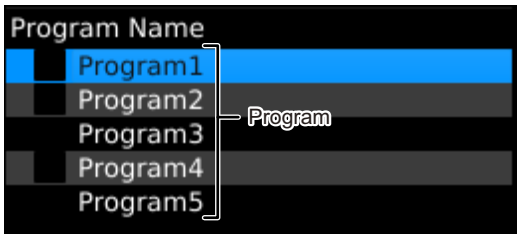
Program Settings

Different programs can be created for each operation mode.

How to view the program editing screen

Press SEQUENCE and then Program to display the sequence editing screen.

When you change the operation mode *(p.21)*, programs that were created in each operation mode are displayed.



Example: Programs 1 to 5 have been registered

Creating a program

First, create an empty program without registering any steps.

Because the location where the program is created depends on the present operation mode, even if a program of the same name is created for example in CC mode and CP mode, the resulting programs will be treated as different programs.

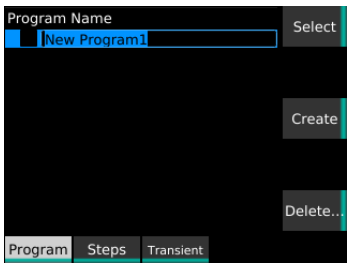
The created program is automatically saved and is not deleted even if the POWER switch is turned off.

1 **Sets the operation mode *(p.21)*.**

2 **Press SEQUENCE and then Program.**

The program editing screen appears.

3 **Press Create.**



If another program has a check mark (is selected), you cannot create a program. If this happens, press Select to remove the check mark.

4 **Use the numeric keypad or the rotary knob to enter the program name, and then press ENTER.**

The program is created.

You can enter up to 255 characters for the program name. For information about registering steps to a program, see “Setting Steps” *(p.63)*.

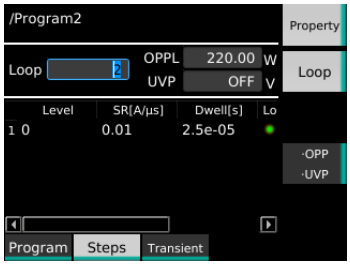
Setting the number of loops of a program

1 **Press SEQUENCE and then Program.**

2 **Use the rotary knob to select the program, and then press Select.**
A check mark appears to the left of the selected program name.

3 **Press Steps, Property and then Loop.**

4 **Use the numeric keypad or the rotary knob to enter the number of loops, and then press ENTER.**



5 **Press Property and then Save.**
The number of loops is saved.

Setting the voltage of CV mode addition (+CV)

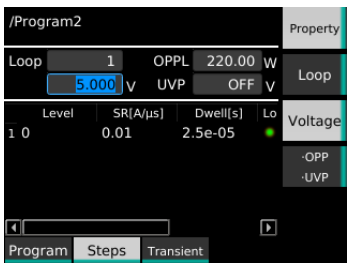
If the CV mode addition function is enabled (CC+CV or CR+CV) in operation mode, you can set the +CV voltage in the program.

1 **Press SEQUENCE and then Program.**

2 **Use the rotary knob to select the program, and then press Select.**
A check mark appears to the left of the selected program name.

3 **Press Steps, Property and then Voltage.**

4 **Use the numeric keypad or the rotary knob to enter the voltage value, and then press ENTER.**



5 **Press Property and then Save.**
The +CV voltage is saved.

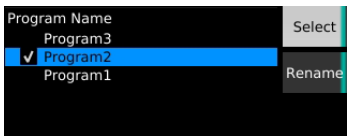
Setting protection functions

You can set overcurrent protection (OCP), overpower protection (OPP), and undervoltage protection (UVP) in a program. The protection functions that you can set varies depending on the operation mode.

1 **Press SEQUENCE and then Program.**

2 **Use the rotary knob to select program, and then press Select.**

A check mark appears to the left of the selected program name.

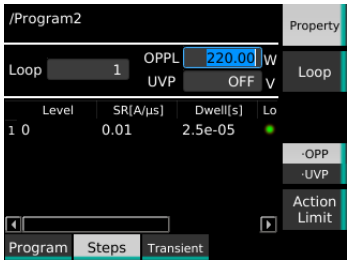


3 **Press Steps, Property and then •OCP/•OPP/•UVP.**

The key names that appear vary depending on the operation mode.

Each time you press the key, the item that you can set changes.

4 **Use the numeric keypad or the rotary knob to enter a value, and then press ENTER.**



5 **Press Property and then Save.**

The protection function is set.

Changing a program name

1 **Press SEQUENCE and then Program.**

2 **Use the rotary knob to select the program, and then press Select.**

A check mark appears to the left of the selected program name.

3 **Press Rename.**

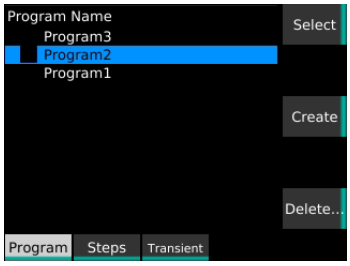
4 **Use the numeric keypad or the rotary knob to enter the program name, and then press ENTER.**

The program name is changed.

Deleting a program

1 **Press SEQUENCE and then Program.**

2 **Use the rotary knob to select the program, and then press Delete.**



If the check box of any program is selected, you cannot delete programs. If a check box is selected, use the rotary knob to select the corresponding program, and then press Select to clear the check box.

3 **Use the rotary knob to select OK, and then Press ENTER.**

The program is deleted.

Setting Steps

Creating steps

1 **Press SEQUENCE and then Program.**

2 **Use the rotary knob to select the program, and then press Select.**

A check mark appears to the left of the selected program name.

3 **Press Steps.**

The step editing screen appears.

4 **To insert a new step, press Insert.**

A step is inserted below the selected step.

5 **Use the rotary knob and the ◀/▶ keys to select a step and item, and then press Edit.**

To confirm an item, press Edit again.

Item	Value	Description
Level[1]	Differs according to the operation mode (A/SIE/V/W)	Load setting of each operation mode. The values that can be set depend on the current operation mode. Use the numeric keypad or the rotary knob to enter a value.
SR	Varies depending on the current range setting *(p.104)*	Slew rate setting. Use the numeric keypad or the rotary knob to enter a value.
Dwell	0.000025 to 3600000	Step execution time (s). Use the numeric keypad or the rotary knob to enter a value.
Load	Load on or off. If on, set the load setting transition method to Immediate ( ) or Ramp ( ).	Select the load state and the load setting transition method *(p.64)*. The value switches between load on and load off each time you press the Load sub-function key. If set to load on, press Immediate or Ramp to select the transition method.
Wait(pre)	MSync/DIGITAL2/BUS	Select the pre-trigger source *(p.64)*. Press MSync, Digital2, and BUS to turn each trigger source on or off. The setting switches between on and off each time you press each key.
Wait(post)	Trig IN	Select the post-trigger source *(p.64)*. Trig IN switches between on and off each time you press the Trig IN key.
Generate	TA Link/Trig Out	Trigger signal output *(p.64)*. Press TA Link and Trig Out to turn each trigger output on or off. The setting switches between on and off each time you press each key.
→	Digital0/Digital1/Digital2	Set each signal to high level during a step *(p.64)*. Press Digital0, Digital1, and Digital2 to turn each item on or off. The setting switches between on and off each time you press each key.

1 This does not appear if the CC, CR, or CP external control is enabled in CC mode, CR mode, or CP mode (including CC+CV and CR+CV) or if the CV external control is enabled in CV mode (including CC+CV and CR+CV).

6 **Repeat step 4 and step 5 until all the steps have been registered.**

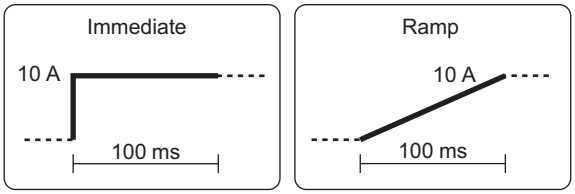
7 **Press Save.**

The steps are registered to the program.

Step transition method

The available load setting transition methods are Ramp and Immediate. With Immediate, the load setting transitions step-wise from the setting of the previous step. With Ramp, the load setting transitions in a ramp from the setting of the previous step. For step 1, the load setting start point is 0 A, 0 S, 0V, or 0 W.

Example: Level: 10A, Dwell: 100 ms



Selecting the trigger source

For Wait(pre) (pre-trigger) and Wait(post) (post-trigger), select the trigger source. If you set the Wait(pre) trigger source, the program pauses before executing the step and waits for a trigger. If you set the Wait(post) trigger source, the program pauses after executing the step and waits for a trigger. If you do not set anything, the transition method is set to Immediate, and the execution of the step starts without the application of a trigger.

Item	Source	Value
Wait(pre)	MSYNc	Synchronizes the resuming of sequences on synchronized PLZ-5Ws *(p.56)*.
	Digital2[1]	Executes the step at the timing at which a signal is input to pin 13 of the EXT CONT connector.
	BUS[2]	Executes the step when the *TRG command is sent from a PC, etc.
Wait(post)	Trig IN	Executes the next step when a trigger is received *(p.81)*.

1 Only when Direction of Digital2 is set to Input *(p.90)*.
2 If set to BUS, other trigger sources cannot be set.

Signal output

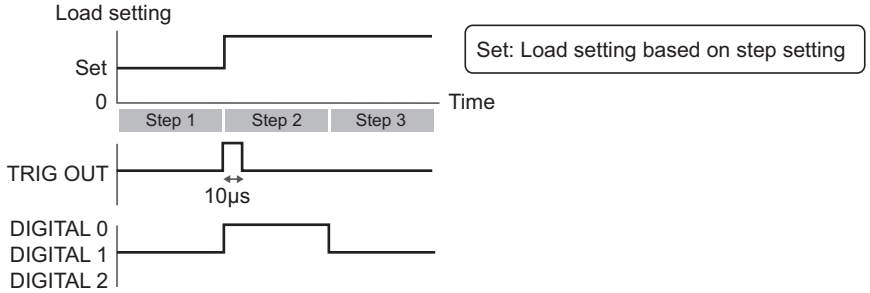
For Generate and →, set the signal output during the step execution.

Item	Source	Value
Generate	TA Link	Output TA Link triggers. If source is set to TA Link on *(p.37)*, measurement starts at the step execution timing.
	Trig Out	Trigger output from the TRIG OUT connector.
→	Digital0	The pin 11 signal of the EXT CONT connector is set to high level.
	Digital1	The pin 12 signal of the EXT CONT connector is set to high level.
	Digital2[1]	The pin 13 signal of the EXT CONT connector is set to high level.

1 Only when Direction of Digital2 is set to Input *(p.90)*

For Trig Out, the trigger is output when a step is executed.
For Digital0, Digital1, Digital2, the signal is set to high level during a step.

Example: When Trig Out, Digital0, Digital1, and Digital2 are set in step 2.



Deleting a step

1 **Press SEQUENCE and then Steps.**

2 **Use the rotary knob to select the step, and then press Delete.**
The selected step is deleted.

3 **Press Save.**
The steps are registered to the program.

Sequence creation tutorial

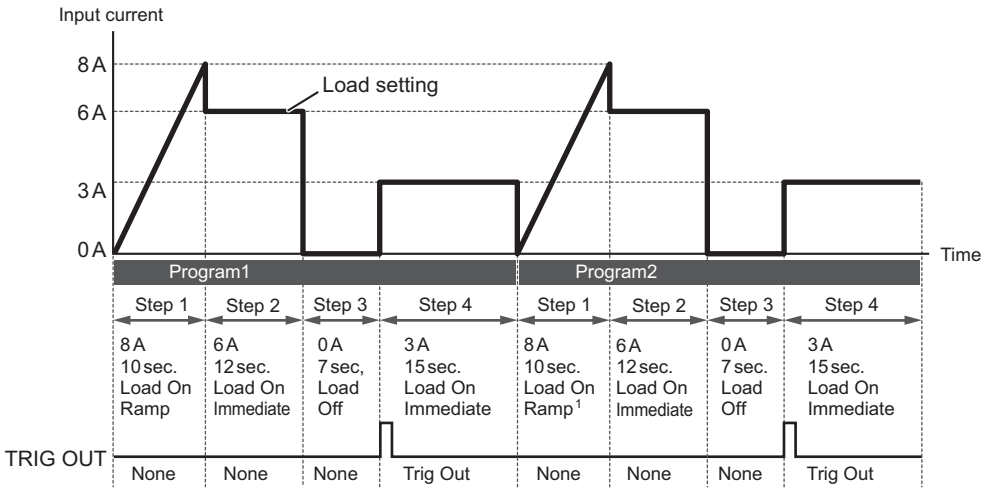
In this example, we will actually create a sequence from the operation panel.
Assuming the use of the PLZ1205W, we will enter the following programs in CC mode.

- Program1

  Program name: Program1, Number of loops: 2

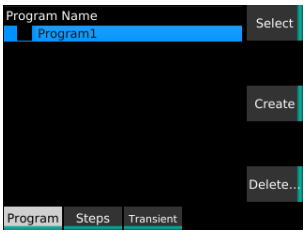
Run	Load setting	Execution time	Load	Transition method	Trigger output
Step 1	8 A	10 seconds	On	Ramp	None
Step 2	6 A	12 seconds	On	Immediate	None
Step 3	0 A	7 seconds	On	–	None
Step 4	3 A	15 seconds	On	Immediate	Trig Out

Program 1 executes step 4 and ends the first execution. When program 1 is executed one more time, this sequence is over.
Representing this sequence in graph form looks as follows.



1 If Load of step 1 is set to Ramp and the program is repeated, the start current of step 1 will always be 0 A.

Newly creating program1

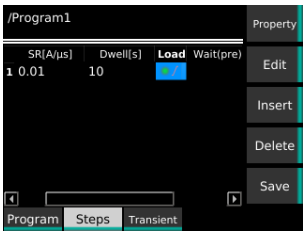


1. **Sets the operation mode to CC mode** *(p.21)*.
2. **Press SEQUENCE, Program, and then Create.**
3. **Use the numeric keypad or the rotary knob to enter program name “Program1”, and then press ENTER.**
   Program1 is created.

Registering steps to program1

Creating step 1

1. **Use the rotary knob to select Program1, and then press Select.**
   A check mark appears to the left of Program1.
2. **Press Steps and then Edit.**
3. **Use the numeric keypad or the rotary knob to enter current value “8”, and then press ENTER.**
4. **Use the ▶ key to select a cell in the Dwell column, and then press Edit.**
5. **Use the numeric keypad or the rotary knob to enter execution time “10”, and then press ENTER.**



6. **Use the ▶ key to select a cell in the Load column, and then press Edit.**
7. **Use the rotary knob to select Ramp, and then press Edit.**

Creating step 2

1 **Press Insert.**
Step 2 is inserted.

2 **Use the rotary knob and the ◀ key to select a cell in the Level column of Step 2 (2nd row), and then press Edit.**

3 **Use the numeric keypad or the rotary knob to enter current value “6”, and then press ENTER.**

4 **Use the ▶ key to select a cell in the Dwell column, and then press Edit.**

5 **Use the numeric keypad or the rotary knob to enter execution time “12”, and then press ENTER.**

6 **Use the ▶ key to select a cell in the Load column, and then press Edit.**

7 **Use the rotary knob to select Immediate, and then press Edit.**

Creating step 3

1 **Press Insert.**
Step 3 is inserted.

2 **Use the rotary knob and the ◀ key to select a cell in the Dwell column of Step 3 (3rd row), and then press Edit.**

3 **Use the numeric keypad or the rotary knob to enter current value “7”, and then press ENTER.**

4 **Use the ▶ key to select a cell in the Load column, and then press Edit.**

5 **Press the Load sub-function key and then Edit.**
The setting changes to Load Off.

Creating step 4

1 **Press Insert.**
Step 4 is inserted.

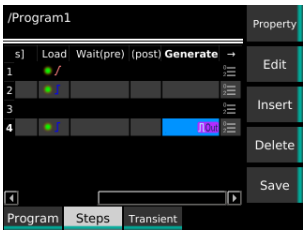
2 **Use the rotary knob and the ◀ key to select a cell in the Level column of Step 4 (4th row), and then press Edit.**

3 **Use the numeric keypad or the rotary knob to enter current value “3”, and then press ENTER.**

4 **Use the ▶ key to select a cell in the Dwell column, and then press Edit.**

5 **Use the numeric keypad or the rotary knob to enter execution time “15”, and then press ENTER.**

6 **Use the ▶ key to select a cell in the Load column, and then press Edit.**



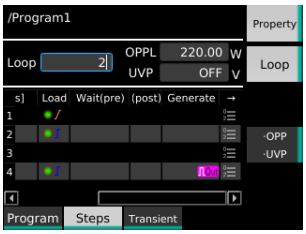
7 **Press the Load sub-function key.**

8 **Press Immediate and then Edit.**

9 **Use the ▶ key to select a cell in the Generate column, and then press Edit.**

10 **Press Trig Out and then Edit.**

Setting the number of loops



1 **Press Property and then Loop.**

2 **Use the numeric keypad or the rotary knob to enter number of loops “2”, and then press ENTER.**

3 **Press Property.**

Saving the Program1

1 **Press Save.**
The Program1 is registered.

Executing, Pausing, and Stopping Sequences

When setting of the programs and steps is completed, the sequence is executed. Pauses and stops can be executed during sequence execution.

Executing a sequence

NOTE During sequence execution, the switching function and short function are forcibly turned off.

The sequence can be executed regardless of whether the load is on or off.

1 Set the operation mode *(p.21)* and range *(p.27)* according to the sequence to be executed.

If the load setting of the sequence exceeds the present range rating, the load setting during sequence execution is limited by the present range rating.

If the load setting of the sequence is less than the present range resolution, the load setting during sequence execution is limited by the present range resolution.

2 Press SEQUENCE and then Program.

3 Use the rotary knob to select the program, and then press Select.

A check mark appears to the left of the program name.

4 Press Transient and then Initiate.

The number of loops that is executing.
/The number of all loops.

The sequence is executed, and the measurement values and appear on the display. When the sequence is completed, a sequence completion message appears.

The value at the end of the sequence will be the value of the last step.

Synchronizing the start timing of sequences

The sequence start timing can be synchronized on synchronized PLZ-5Ws.
For details, see “Synchronizing the start of sequences” *(p.55)*.

Pauses the sequence

1 Press Suspend during sequence execution.

The sequence is paused. Press Resume to restart the sequence.
Pressing Abort during a pause stops the sequence.

Stopping a sequence

Pressing Abort during sequence execution stops the sequence execution that is in progress (if the load is on, it remains on as is).

Setting triggers

By setting triggers, you can control the timing at which sequences are to be started.

In addition, you can set an event (trigger source) that will be used as a condition for starting sequences.

1 **Press SOURCE and then More.**

2 **Use the rotary knob to select the item, and then press Edit.**

Item	Setting	Description
Trigger	–	Sets the trigger.
Source	Immediate/ BUS/DIGITAL2/ MSync	Sets the trigger source. For details, see“Selecting the trigger source” below.
Delay	0 to 100	Sets the delay time [s] from trigger application until the start of sequence.

3 **Use the rotary knob or numeric keys to perform input, and then press ENTER.**

Repeat steps 2 and 3 to set triggers.

■ Selecting the trigger source

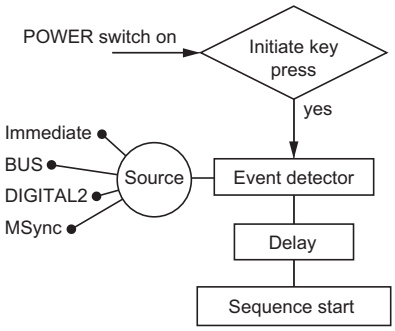
Pressing Initiate causes the PLZ-5W to enter a trigger-wait state. When a trigger selected with Source occurs, the trigger-wait is cleared, and sequence starts. *(p.71)*

Trigger source	Description
Immediate	Starts sequence at the internal timing of the PLZ-5W without waiting for trigger application.
BUS	Starts sequence when the *TRG command is transmitted from a PC or the like.
DIGITAL2[1]	Starts sequence at the timing at which a signal is input to pin 13 of the EXT CONT connector.
MSYNc	The sequence start timing can be synchronized on synchronized PLZ-5Ws. *(p.55)*

1 Only when Direction of Digital 2 is set to Input *(p.90)*.

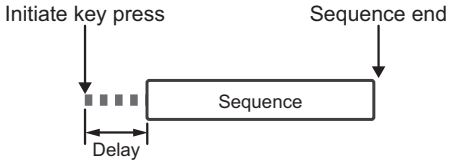
■ Trigger processing procedure

The general trigger processing procedure is illustrated in the following figures.

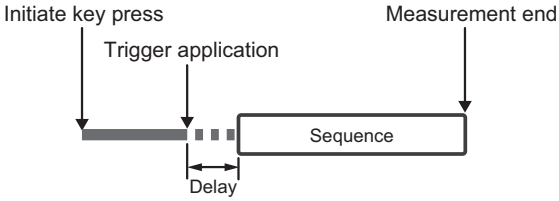


■ Trigger application examples

Example: Immediate is set for Source.



Example: BUS/DIGITAL2/MSync is set for Source.



5 External Control

Preparation for External Control

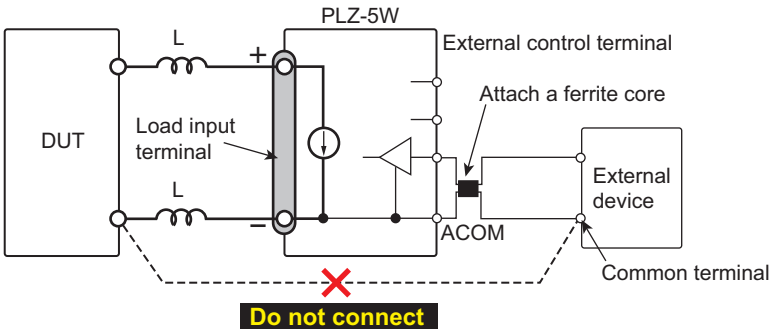
By connecting the rear-panel EXT CONT connector, front-panel BNC terminals (I MON OUT connector, TRIGOUT connector) to an external device with signal cables, you can control and monitor the PLZ-5W from the external device (external control).

The BNC terminals are isolated from the chassis and load input terminals.

Control method	Functions that can be controlled/monitored	Connector
Analog voltage control	Controls the load setting of CC, CP, CR, and CV modes using voltage. Controls the current to be superimposed on the load setting of CC mode using voltage.	EXT CONT
Digital control	Load on/off control Current range control Trigger for sequence function and measurement function Resumption of paused sequence operation Activation of an alarm Clearing an alarm state	EXT CONT
signal output	Monitoring of load on/off state Monitoring of current range Monitoring of alarm occurrence Relay contact output of short function	EXT CONT
	Monitoring of input current	EXT CONT I MON OUT
	Trigger output for switching and sequence	TRIG OUT

Precautions for high-speed load simulations

During high-speed load simulation, do not connect the common terminal of the external device to the terminal of the DUT (the terminal that is connected to the negative (−) input terminal of the PLZ-5W). Attach a commercially available ferrite core to the wiring between the PLZ-5W and the external device.



Connecting the EXT CONT connector

Storing the protection plate

⚠WARNING **Risk of electric shock. The EXT CONT connector contain pins that have the same potential as the output terminal. When the connector is not in use, be sure to attach the protection plate that comes with the PLZ-5W.**

By factory default, the protection plate is mounted on the EXT CONT connector. When using the EXT CONT connector, keep the removed protection plate in a safe place. If it is damaged or lost, contact your Kikusui agent or distributor.

External control connector kit

To connect the signal cable to the EXT CONT connector, use the external control connector kit that comes with the PLZ-5W. For information about how to use this kit, see the TE Connectivity (formerly AMP) catalog. For information about how to obtain these tools or replacement parts, contact your Kikusui agent or distributor.

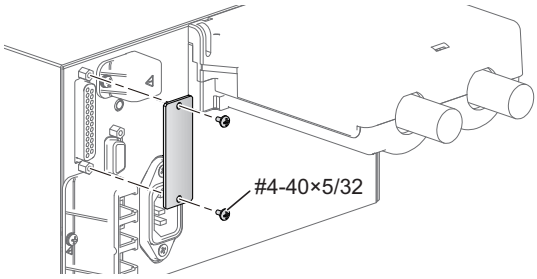
Connector model	5747461-3 [made by TE Connectivity]
Plug model	745211-7 [made by TE Connectivity]
Wire diameter	AWG26 to AWG22
Manual pressure welding tool	Handle assembly 58074-1 [made by TE Connectivity] Head assembly 58063-2 [made by TE Connectivity]
Insertion/extraction tool	91232-1 [made by TE Connectivity] or equivalent

For the pin arrangement, see “EXT CONT connector pin arrangement” *(p.74)*.

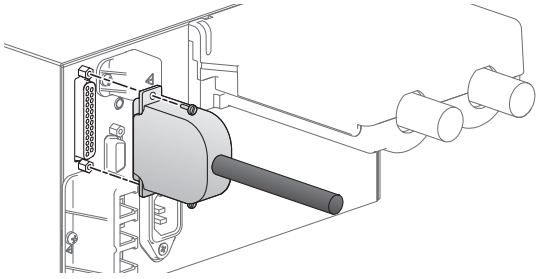
Connecting the signal cable

1 **Turn off the PLZ-5W’s POWER switch.**

2 **Remove the protection plate of the EXT CONT connector.**



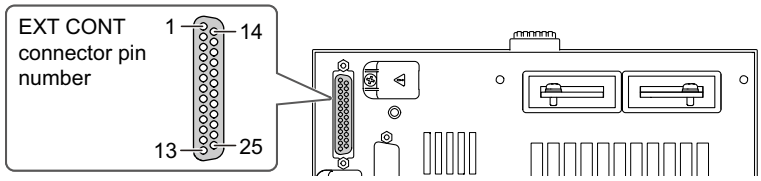
3 **Connect the signal cable to the EXT CONT connector.**



4 **Connect the signal cable to the external controller.**

This completes the external control connection procedure.

EXT CONT connector pin arrangement



Pin no.	In/Out	Signal name	Description
1	--	STATUS COM	Status signal common for pins 2, 3, 14 to 16.
2	OUT	RANGE STATUS 0	Range status output *(p.79)*.
3	OUT	RANGE STATUS 1	
4	IN	RANGE CONT 0	Range switch input *(p.79)*.
5	IN	ALARM CLEAR	Alarm clearing input *(p.80)*.
6	IN	ALARM INPUT	Alarm input *(p.80)*.
7	OUT	SHORT SIGNAL OUT	Relay contact output (30 Vdc/1 A) *(p.28)*.
8	OUT	SHORT SIGNAL OUT	
9	IN	TRIG INPUT	Trigger input. Resumes program execution if Wait(post) was set to Trig IN in a sequence step and the program was paused *(p.81)*.
10	--	A COM	Connected to the negative (−) polarity of the load input terminals on the rear panel.
11	OUT	DIGITAL 0	DIGITAL 0 output *(p.81)*. Sequence control possible.
12	OUT	DIGITAL 1	DIGITAL 1 output *(p.81)*. Sequence control possible.
13	IN/ OUT	DIGITAL 2	DIGITAL2 I/O *(p.81)*. Input/output switchable *(p.90)*. Sequence signal output or the trigger input of sequences and measurement function.
14	OUT	ALARM1	ALARM1 output *(p.80)*. ON when overvoltage detection, reverse-connection detection, overheat detection, alarm input detection, front-panel load input terminal overcurrent detection or parallel operation anomaly detection is activated, and also during external alarm input.
15	OUT	ALARM2	ALARM2 output *(p.80)*. ON during OCP, OPP, UVP, or WDP operation.
16	OUT	LOAD ON STATUS	Load-on status output *(p.79)*. ON during load on.
17	IN	RANGE CONT 1	Range switch input *(p.79)*.
18	IN	LOAD ON/OFF CONT	Load on/off control input *(p.78)*. Logic level switchable.
19	--	A COM	Connected to the negative (−) polarity of the load input terminals on the rear panel.
20	IN	EXT CONT ADD	External voltage control input *(p.77)*. Control by adding the current to the CC mode's load setting.
21	IN	EXT CONT MODE	External voltage control input *(p.75)*. Control load setting of CC, CR, and CP modes.
22	IN	EXT CONT CV	External voltage control input *(p.76)*. Control voltage of CV modes.
23	--	A COM	Connected to the negative (−) polarity of the load input terminals on the rear panel.
24	OUT	IMON	Current monitor output *(p.79)*.
25	--	N.C.	--

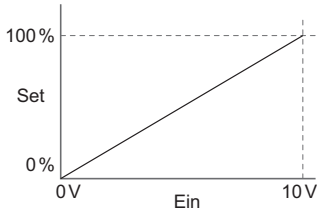
Load Setting Control

Constant current (CC), constant resistance (CR), and constant power (CP) control

You can control the load setting of CC, CR, and CP modes using external voltage.

When you apply an external voltage between 0 V to 10 V to the EXT CONT connector, a load setting proportional to the change can be obtained.

An external voltage of 0 V results in a load setting that is 0 % of the rating, and an external voltage of 10 V in a load setting that is 100 % of the rating. The accuracy cannot be guaranteed when the external voltage is less than 0 V or more than 10 V.



Set: Load setting
Ein: External voltage

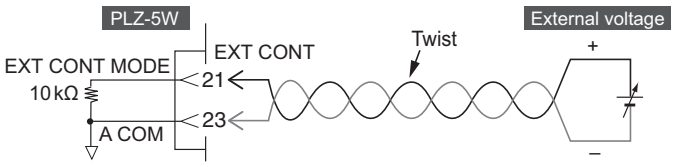
⚠ CAUTION To avoid damaging the product, observe the following precautions.

- The maximum voltage that can be applied across pins 21 and 23 of the EXT CONT connector is ±11 V. Do not apply a voltage that exceeds this.
- Pin 23 of the EXT CONT connector is connected to the negative (−) load input terminal. Make sure that the wire of pin 23 does not touch any of the other pins.

1 Turn the POWER switch off.

2 Connect an external voltage across pins 21 and 23 of the EXT CONT connector.

To prevent noise interference, use twisted wires for the signal cables.
Use a highly stable external voltage that has low noise.



3 Turn the POWER switch on and check that the load is off.

4 Sets the operation mode to CC, CR or CP, and set the current range.

If you also want to control the current range externally, be sure to set the range to H.

5 Press SOURCE and then More.

6 Use the rotary knob to select CC/CR/CP under External Control, and then press Edit.

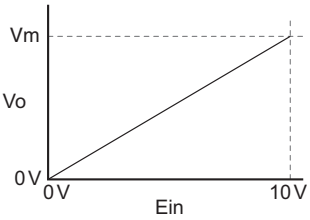
7 Use the rotary knob to select Enable, and then press ENTER.

External control of each mode becomes possible.

Constant voltage (CV) control

You can control the voltage in CV mode, CC+CV mode, or CR+CV mode using external voltage. When you apply an external voltage of 0 V to 10 V to the EXT CONT connector, the voltage varies proportionally to that external voltage.

An external voltage of 0 V results in voltage of 0 V. An external voltage of 10 V results in voltage of 100% of the specified range. The accuracy cannot be guaranteed when the external voltage is less than 0 V or more than 10 V.



Vo : Input voltage
Vm : Rated voltage
Ein : External voltage

$$Vo \approx \frac{Vm \times Ein}{10}$$

$0 \le Ein \le 10\ V$

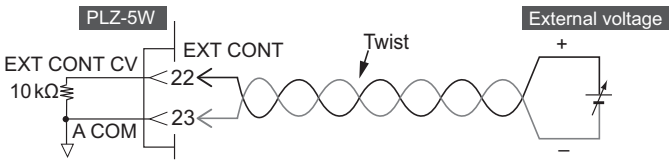
⚠CAUTION To avoid damaging the product, observe the following precautions.

- The maximum voltage that can be applied across pins 22 and 23 of the EXT CONT connector is ±11 V. Do not apply a voltage that exceeds this.
- Pin 23 of the EXT CONT connector is connected to the negative (−) load input terminal. Make sure that the wire of pin 23 does not touch any of the other pins.

1 Turn the POWER switch off.

2 Connect an external voltage across pins 22 and 23 of the EXT CONT connector.

To prevent noise interference, use twisted wires for the signal cables. Use a highly stable external voltage that has low noise.



3 Turn the POWER switch on and check that the load is off.

4 Set the operation mode and the current range.

If you also want to control the current range externally, be sure to set the range to H.

5 Press SOURCE and then More.

6 Use the rotary knob to select CV under External Control, and then press Edit.

7 Use the rotary knob to select Enable, and then press ENTER.

You can now externally control the voltage in CV mode, CC+CV mode, or CR+CV mode.

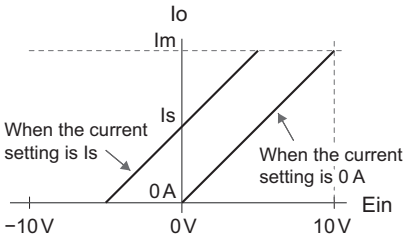
Controlling the current to be superimposed on the constant current (CC)

You can control the current to be superimposed to the current value of CC mode with an external voltage.

When you apply an external voltage between 0 V to 10 V to the EXT CONT connector, the load current becomes the sum of the current proportional to the external voltage change and the Present current setting.

When you apply an external voltage between -10 V to 0 V to the EXT CONT connector, the load current is equal to the current that is proportional to the external voltage change subtracted from the present current setting.

The current that is added to the current setting for an external voltage of 0 V is 0 A. The current that is added to the current setting for an external voltage of ±10 V is 100% of the rating. However, the final load current range is 0 A to 100% of the rating.



Io: Load current
Im: Rated current
Is: Current setting
Ein: External voltage

$$Io \approx \frac{Im \times Ein}{10} + Is$$

$-10\,V \le Ein \le 10\,V$

$0\,A \le Io \le Im$

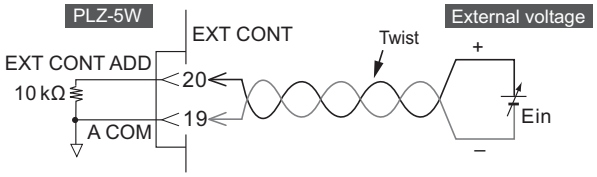
⚠ CAUTION To avoid damaging the product, observe the following precautions.

- The maximum voltage that can be applied across pins 19 and 20 of the EXT CONT connector is ±11 V. Do not apply a voltage that exceeds this.
- Pin 19 of the EXT CONT connector is connected to the negative (−) load input terminal. Make sure that the wire of pin 19 does not touch any of the other pins.

1 Turn the POWER switch off.

2 Connect an external voltage across pins 19 and 20 of the EXT CONT connector.

To prevent noise interference, use twisted wires for the signal cables. Use a highly stable external voltage that has low noise.



3 Turn the POWER switch on and check that the load is off.

4 Sets the operation mode to CC mode, and set the current range.

If you also want to control the current range externally, be sure to set the range to H.

5 Press SOURCE and then More.

6 Use the rotary knob to select CC Add under External Control, and then press Edit.

7 Use the rotary knob to select Enable, and then press ENTER.

External control of superimposing in CC mode is now possible.

Control of Load On/Load Off

You can control load on and load off with an external signal. You can also monitor the load on/off state.

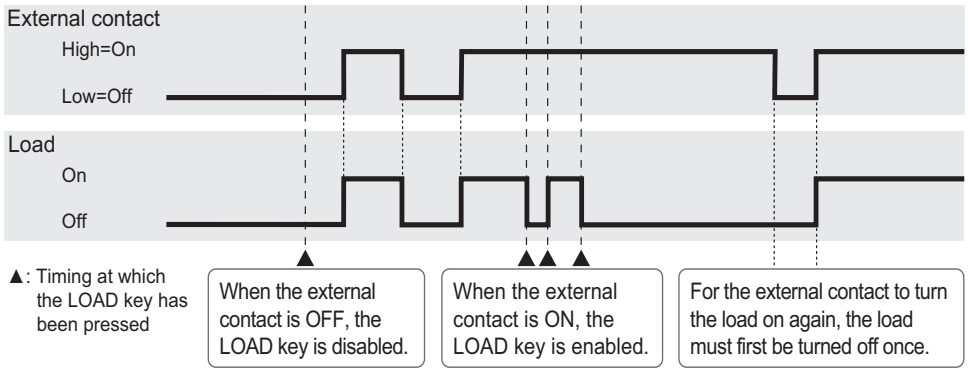
Load on/off control input

You can externally control load on and load off with an external signal, by using an external contact.

The priority relationship between the operation of the external contact and the operation of the LOAD key on the front panel is as shown in the following figure.

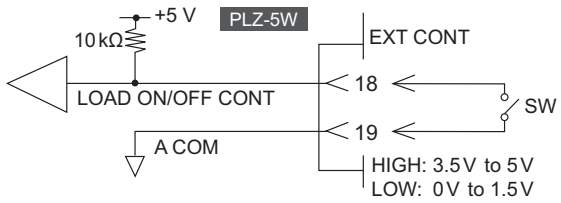
When remote control is used, the external contact operation shares the same priority level as the LOAD key operation.

Relationship between external contact and LOAD key (when Input Logic is Positive)



1 **Turn the POWER switch off.**

2 **Connect an external signal across pins 18 and 19 of the EXT CONT connector.**



3 **Press SOURCE and then More.**

4 **Use the rotary knob to select Input Logic under External Control, and then press Edit.**

5 **Use the rotary knob to select the item, and then press ENTER.**

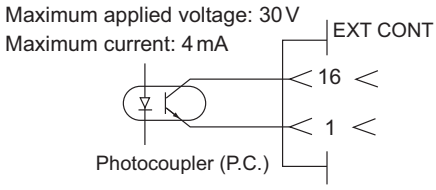
Item	Description
Positive	Opening and closing the external contact turns the load on and off, respectively.
Negative	Opening and closing the external contact turns the load off and on, respectively.

External control of load on/load off is now possible.

Load-on status signal output

When externally monitoring the load on/load off state, use pin 16 of the EXT CONT connector. Use pin 1 as the common.

	Load on	Load off
Photocoupler	ON	OFF



Control of the Current Range

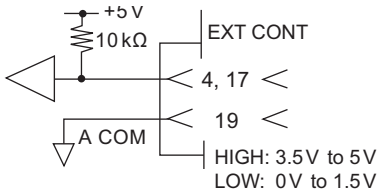
You can control the current range with an external control signal. You can also monitor the current range state by using range status output.

Current Range				Range switch input[1]		Range status output[2]	
	PLZ 205W	PLZ 405W	PLZ 1205W	RANGE CONT 0	RANGE CONT 1	RANGE STATUS 0	RANGE STATUS 1
H	40 A	80 A	240 A	HIGH	HIGH	OFF	OFF
M	4 A	8 A	24 A	HIGH	LOW	OFF	ON
L	0.4 A	0.8 A	2.4 A	LOW	HIGH	ON	OFF

1 HIGH: 5 V, LOW: 0 V
2 OFF: OPEN, ON: SHORT

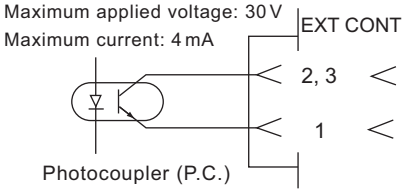
NOTE When externally controlling the current range, set the current range of the PLZ-5W to the H range beforehand *(p.27)*.

Range control input



Use pin 4 (RANGE CONT 0) and pin 17 (RANGE CONT 1) of the EXT CONT connector. Use pin 19 as the common. This is a 2-bit signal.

Range status output

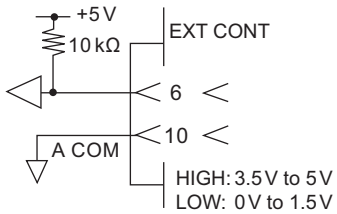


Use pin 2 (RANGE STATUS 0) and pin 3 (RANGE STATUS 1) of the EXT CONT connector. Use pin 1 as the common. This is a 2-bit signal.

Control of the Alarm Signal

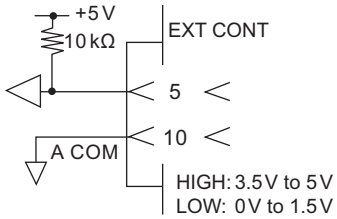
You can use an external control signal to activate the PLZ-5W's alarm. You can also monitor alarm occurrences.

Alarm input



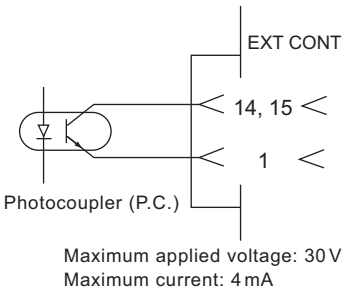
Use pin 6 of the EXT CONT connector. Use pin 10 as the common. An alarm is activated when the input to pin 6 is a low level signal.

Alarm clearing input



Use pin 5 of the EXT CONT connector. Use pin 10 as the common. After an alarm occurs, eliminate the root cause of the alarm, and change the input to pin 5 of the EXT CONT connector from a low level signal to a high level signal. The alarm will be cleared on the rising edge of this signal.

Alarm status output



Use pin 14 (ALARM1) and pin 15 (ALARM2) of the EXT CONT connector. Use pin 1 as the common.

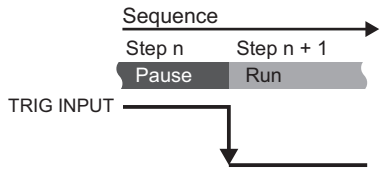
Pin 14 turns on when alarm 1 *(p.32)* is activated.

Pin 15 turns on when alarm 2 *(p.32)* is activated.

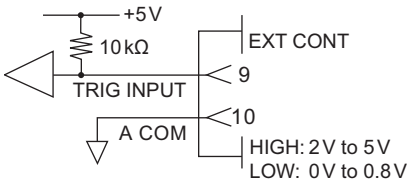
Trigger Input/Output

There is a trigger output connector (TRIG OUT) on the front panel, and a trigger input connector (EXT CONT pin 9) on the rear panel.

Trigger input



When “Wait(post)” is set to “Trig IN” in the sequence step setting *(p.63)*, the sequence is paused at the end of a step. In this case, when the signal input to TRIG INPUT (pin 9) of the EXT CONT connector changes from HIGH to LOW level, the pause is released at the falling edge of that signal.

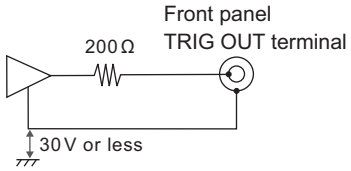


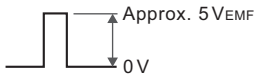
Trigger output

The trigger signal is output under the following conditions.

Conditions	Pulse width
During switching operation *(p.29)*.	1 µs
When a step for which “Trig Out” has been set is executed during sequence operation *(p.64)*.	10 µs

The trigger signal is output from the TRIG OUT connector (BNC connector) on the front panel. The voltage of the trigger signal output is approximately 5 VEMF, the output impedance is approximately 200 Ω. The isolation voltage between the BNC terminals and chassis is ±30 V. The rated isolation voltage between BNC terminals and load input terminals is ±500 V. The TRIG OUT connector is isolated from the chassis and load terminal (A COM).

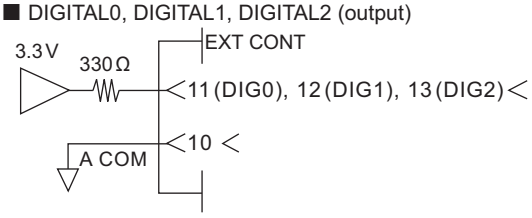




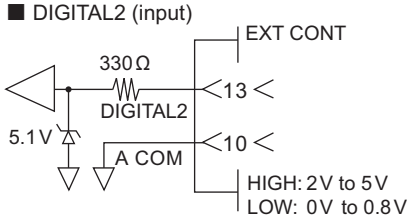
Digital I/O

The rear-panel EXT CONT connectors include digital output (DIGITAL0, DIGITAL1, DIGITAL2) and digital input (DIGITAL2). The input and output of DIGITAL2 can be switched *(p.90)*. Digital output is used as a logic signal output during a step of a sequence. Digital input is used as a trigger input for sequence and measurement functions.

■ DIGITAL0, DIGITAL1, DIGITAL2 (output)



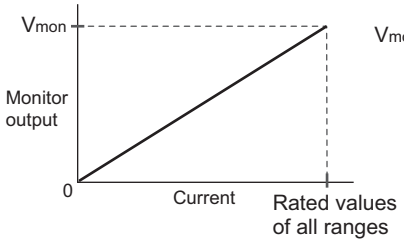
■ DIGITAL2 (input)



Using the Current Monitor Signal

Current monitor output

You can monitor the current value by using the current monitor signal output. The current monitor signal is output from the I MON OUT connector on the PLZ-5W front panel and across pins 23 and 24 (pin 23 is common) of the EXT CONT connector.

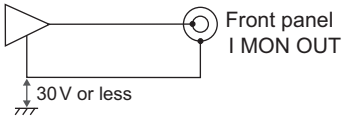


V_{mon}: Monitor signal output

signal output	V_{mon}
I MON OUT connector	2 V
Pins 23 and 24 of the EXT CONT connector	10 V

⚠CAUTION To avoid damaging the product, observe the following precautions. Pin 23 of the EXT CONT connector is connected to the negative (−) load input terminal. Make sure that the wire of pin 23 does not touch any of the other pins.

■ Connecting to front panel I MON OUT connector (BNC connector)



The current monitor signal that is output is 2 V in the rating for each range. The maximum output current is 5 mA. The isolation voltage between the BNC terminals and chassis is ±30 V. The rated isolation voltage between the BNC terminals and load input terminals is ±500 V. A It is isolated from A COM.

■ Connecting across pins 23 and 24 of the EXT CONT connector

The common is connected to A COM. The current monitor signal that is output is 10 V in the rating for each range. The output impedance is 1 kΩ.

6 Parallel Operation

Overview of Parallel Operation

The PLZ-5W can be connected in parallel to increase the total current and power capacities. During parallel operation, one unit is set as the master unit. The master unit can control all the PLZ-5W units (slave units) that are connected in parallel. The master unit displays the total current and total power for all the electronic loads that are connected in parallel.

You can use one of the following two methods to perform parallel operation:

■ Parallel operation using the same type of electronic loads

This method involves connecting slave units (same model as the master unit) to one PLZ-5W master unit. You can connect up to four slave units. The master unit and the slave units are automatically set according to the connection status.

■ Parallel operation using boosters (PLZ1205W only)

This method involves connecting boosters (PLZ2405WB) to one PLZ1205W unit. You can connect up to four boosters. For details on how to connect units for parallel operation using boosters, see the PLZ2405WB user's manual on the included CD-ROM.

⚠ CAUTION

- To avoid damaging the product, observe the following precautions. During parallel operation, do not use the input terminals on the front panel.

NOTE

- During parallel operation, the product may not meet the specifications that it has during independent operation. The setting accuracy and measurement accuracy can be improved by performing calibration in a parallel state. To have your PLZ-5W calibrated, contact your Kikusui agent or distributor.
- The current ripple during parallel operation is approximately equal to the value in the specifications for independent operation multiplied by the number of units in parallel operation.
- The setting resolution during parallel operation varies depending on the number of units in parallel operation.
- The range during parallel operation varies depending on the models connected in parallel. *(p.129)*

Parallel operation using the same model

Connect slave units to a single PLZ-5W master unit using the optional parallel operation signal cable kits *(p.133)*. You can connect up to four slave units.

WARNING **Using improper cables may cause fire. Use load cables with a core diameter that is appropriate for the amount of current being used and with sturdy, flame-resistant insulation.**

CAUTION To avoid damaging the product, observe the following precautions.

- When you are performing parallel operation, be sure to use the load input terminal on the rear panel.
- Do not connect the PARALLEL connector's IN and OUT connector incorrectly.
- Do not perform standalone operation with the signal cable left connected to the PARALLEL connector.

Slave unit The number of units	Maximum current / Maximum power		
	PLZ205W	PLZ405W	PLZ1205W
1 units	80 A/400 W	160 A/800 W	480 A/2400 W
2 units	120 A/600 W	240 A/1200 W	720 A/3600 W
3 units	160 A/800 W	320 A/1600 W	960 A/4800 W
4 units	200 A/1000 W	400 A/2000 W	1200 A/6000 W

Performing connections for parallel operation

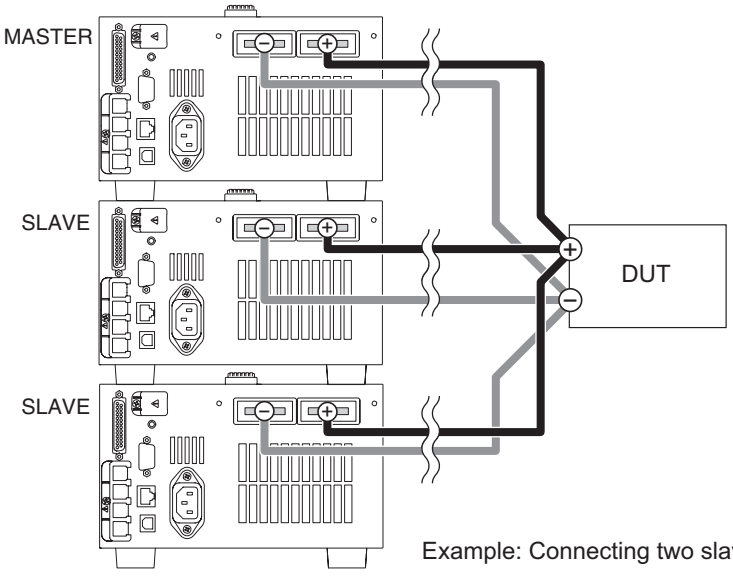
Connect the PLZ-5Ws to be operated in parallel to the DUT, and connect each unit using parallel operation signal cable kits. Use load cables that are as short as possible and have sufficient thickness for the current to be used. We recommend that you use busbars. Route the load cables as far as possible from the signal cables as too close a distance may cause unstable operation.

1 **Turn the load off of all PLZ-5Ws to be connected in parallel.**

2 **Connect the load input terminals of each electronic load to the DUT.**

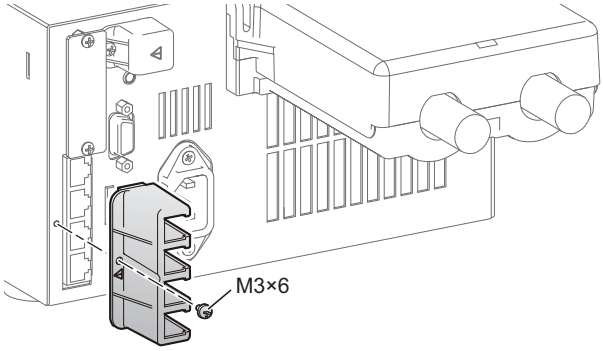
Connect the load input terminals of multiple electronic loads that are the same model to each other in parallel. After performing the connections, be sure to attach the load input terminal covers *(p.16)*.

By performing the wiring as shown in the following figure, you can divide the current evenly among the various load cables. Use load cables that are all of the same length.

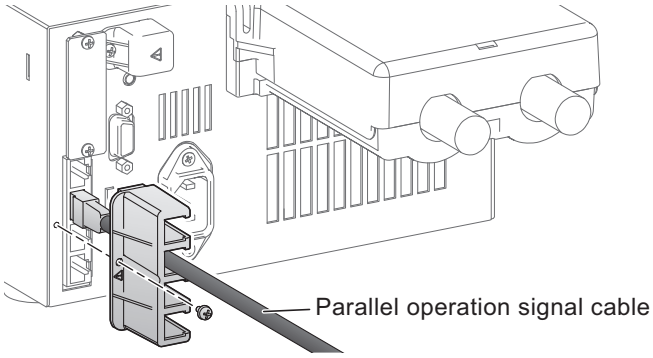


Example: Connecting two slave units

3 **Remove the SYNC/PARALLEL port cover on the rear panel of the electronic load to be used as the master unit.**



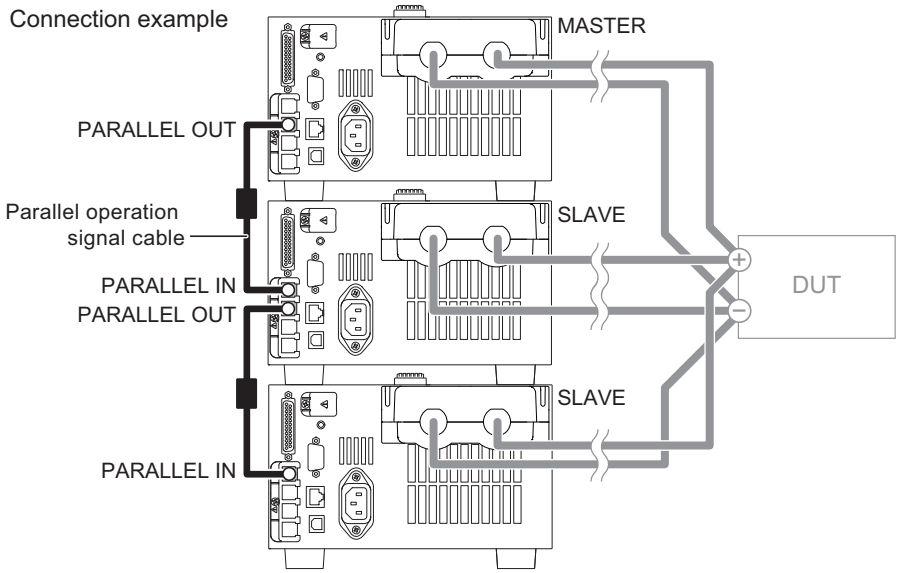
4 **Connect a parallel operation signal cable to the PARALLEL OUT port, and attach the SYNC/PARALLEL port cover.**



5 **Connect all the electronic loads to be operated in parallel with signal cables.**

Connect the PARALLEL OUT connector and IN connectors with a parallel operation signal cable. After connecting, be sure to attach the SYNC/PARALLEL port cover while referring to step4.

Connection example



This completes connection procedure.

Performing parallel operation

Once a parallel connection is made, the master unit and slave units are automatically identified, so parallel operation can be used immediately. In addition, the current range on the master unit display increases.

Turning the power on/off

Turn the POWER switches of all the PLZ-5Ws on or off in any order.

Slew rate and response speed settings during parallel operation

During parallel operation, the slew rate and response speed settings on the master unit are used. The slew rate increases proportionally to the number of units operating in parallel. For details, see “Slew rate during parallel operation using the same type of electronic loads” *(p.129)* or “Slew rate during parallel operation using boosters” *(p.131)*.

In the following cases, set the response speed to Normal to ensure stable operation.

- If the inductance of the wiring will be increased and large voltage drops will occur owing to current changes.
- If control of the PLZ-5W may become unstable and oscillation phenomena may occur owing to phase lag of the current.

Protection function during parallel operation (parallel operation anomaly detection)

When an anomaly occurs during parallel operation, the following alarms appear on the displays of the master and slave units, and the loads are turned off.

Alarm name	Applicable unit	Description	Clearing method
Parallel Communication Alarm	Master unit	Detection of communication anomaly during parallel operation.	Restart
Parallel Slave Front Alarm	Master unit	A current of 80 A or higher flowed through the front panel load input terminals of a slave unit.	Press ENTER on the master unit.
Front Alarm	Slave unit	A current of 80 A or higher flowed through the front panel load input terminals of a slave unit.	Press ENTER on the master unit.
Parallel Slave Over Temperature Alarm	Master unit	Detection of overheating of slave unit.	Press ENTER on the master unit.
OTP Alarm	Slave unit	Detection of overheating of master unit.	Press ENTER on the master unit.
AC Fail Alarm	Master unit	The power of the slave unit is interrupted.	Restart
Parallel Master Lost Alarm	Slave unit	The master unit cannot be detected.	Restart
Alarm	Slave unit	The alarm of another unit is detected.	Press ENTER on the master unit.

Canceling parallel operation

To end parallel operation and return to standalone operation, turn all the units off, and then remove the parallel operation signal cable from the PARALLEL connectors.

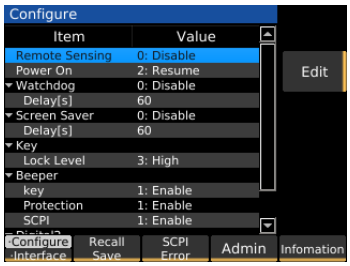
⚠CAUTION

- To avoid damaging the product, observe the following precautions. Do not perform standalone operation with the parallel operation signal cable left connected to the PARALLEL connector.

7 System Settings

Displaying/Changing the Basic Settings

1 **Press SYSTEM.**



The Configure screen appears.

If the Configure screen does not appear, press Configure.

2 **Use the rotary knob to select the setting item, and then press Edit.**

For detailed information about each setting, see “List of setting items” below.

3 **Use the rotary knob or numeric keys to perform input, and then press ENTER.**

This completes the settings.

List of setting items

The factory default settings are underlined.

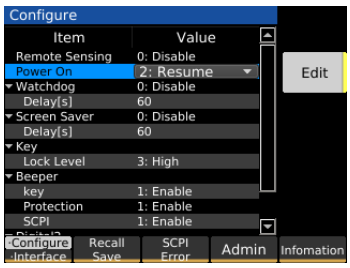
Item		Value	Description
Remote Sensing		Enable/<u>Disable</u>	Remote sensing function *(p.45)*.
Power On		RST/RCL0/<u>Resume</u>	Panel settings at startup *(p.88)*.
Watchdog		Enable/<u>Disable</u>	Setting of protection by watchdog *(p.35)*.
	Delay	1 second to 3600 seconds (1 second unit). Factory default is 60 seconds.	Time until watchdog times out *(p.35)*.
Screen Saver		Enable/<u>Disable</u>	Screen saver function *(p.88)*.
	Delay	60 seconds to 59940 seconds (after setting, rounded to nearest second unit). Factory default is 60 seconds.	Time until the screen saver starts.
Key		–	–
	Lock Level	Low/Medium/<u>High</u>	Setting of key lock level *(p.89)*.
Beeper		–	Setting of beep sound *(p.90)*.
	Key	<u>Enable</u>/Disable	Setting of beep sound in case of invalid operation.
	Protection	<u>Enable</u>/Disable	Setting of beep sound upon alarm occurrence.
	SCPI	<u>Enable</u>/Disable	Setting of SCPI error beep sound.
Digital2		–	–
	Direction	<u>Input</u>/Output	Setting of I/O direction of DIGITAL2 signal *(p.90)*.

Panel settings at startup

The panel setting state at power-on can be selected.

1 **Press SYSTEM.**
If the Configure screen does not appear, press Configure.

2 **Use the rotary knob to select Power On, and then press Edit.**



3 **Use the rotary knob to select the following items.**

Item	Description
RST	Start with the reset settings *(p.95)*.
RCL0	Start in setup memory *(p.50)* 0 condition.
Resume	Start with the same settings as when the power was switched off the previous time (but always load off).

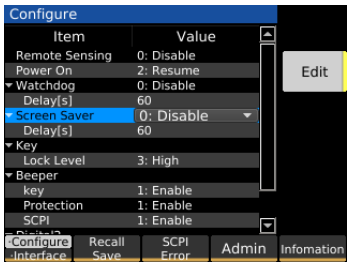
4 **Press ENTER.**
This completes the settings.

Screen saver

The display dims when the PLZ-5W is not operated for a specified length of time.

1 **Press SYSTEM.**
If the Configure screen does not appear, press Configure.

2 **Use the rotary knob to select Screen Saver, and then press Edit.**



3 **Use the rotary knob to select Enable, and then press ENTER.**

4 **Use the rotary knob to select Delay, and then press Edit.**

5 **Use the rotary knob or numeric keys to perform input, and then press ENTER.**
This completes the settings.

Key lock

You can prohibit operation of the keys of the PLZ-5W to prevent erroneous operations such as settings getting changed or memories and sequences getting overwritten.

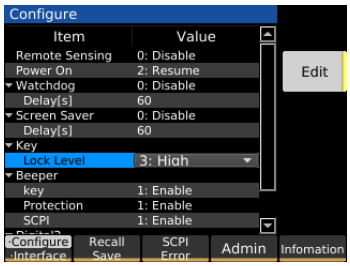
Setting the key lock level

You can set three different key lock levels according to the type of keys whose operation is prohibited.

1 **Press SYSTEM.**

If the Configure screen does not appear, press Configure.

2 **Use the rotary knob to select Lock Level under Key, and then press Edit.**



3 **Use the rotary knob to select the key lock level.**

Security level	Description
1:Low	Locks all operations except the following. • Release key lock • Load on/off • Used to recall setup memory • ABC preset memory recall
2:Medium	Locks all operations except the following. • Release key lock • Load on/off
3:High	All key operations are locked except key lock release.

4 **Press ENTER.**

This completes the settings.

Setting/releasing key lock

1 **Hold down KEY LOCK.**

Each time KEY LOCK is held down, key lock switches between lock and unlock. While key lock is enabled, 1, 2, or 3 is shown on the display depending on the key lock level.

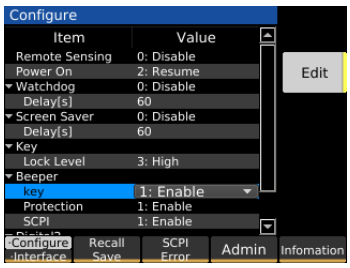
Setting the beep sound

You can set a beep sound to be emitted in case of invalid operation, alarm occurrence, and SCPI error.

1 **Press SYSTEM.**

If the Configure screen does not appear, press Configure.

2 **Use the rotary knob to select the following items under Beeper, and then press Edit.**



Item	Description
Key	Setting of beep sound in case of invalid operation.
Protection	Setting of beep sound in case of alarm occurrence.
SCPI	Setting of beep sound in case of SCPI error.

3 **Use the rotary knob to select Enable/Disable, and then press ENTER.**

This completes the settings.

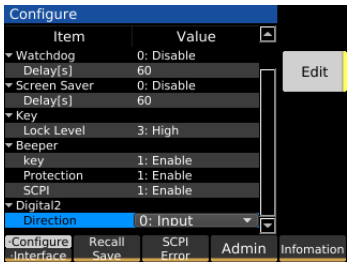
Setting the DIGITAL2 signal input/output

Setting the I/O direction of the DIGITAL2 signal.

1 **Press SYSTEM.**

If the Configure screen does not appear, press Configure.

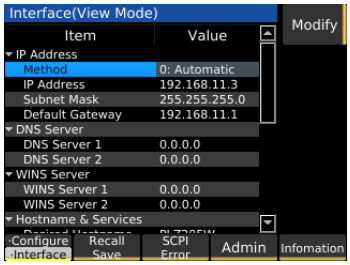
2 **Use the rotary knob to select Direction under Digital2, and then press Edit.**



3 **Use the rotary knob to select Input/Output, and then press ENTER.**

This completes the setting.

1 **Press SYSTEM, and then Interface.**



The Interface screen appears.

If the Configure screen does not appear, press Interface again.

2 **Press Modify, and then use the rotary knob to select the setting item.**

For detailed information about each setting, see “List of setting items” below.

3 **Press Edit, use the numeric keypad or the rotary knob to enter the value, and then press ENTER.**

4 **Press Apply, and then ENTER.**

This completes the settings.

List of setting items

The factory default settings are underlined.

Item	Value	Description	Reset
IP Address			
Method	Automatic/Static	IP address allocation method	✓
IP Address	–	IP address	–
Subnet Mask	–	Subnet mask	–
Default Gateway	–	Default gateway	–
DNS Server			
DNS Server 1	–	Primary DNS server address	–
DNS Server 2	–	Secondary DNS server address	–
WINS Server			
WINS Server 1	–	Primary WINS server address	–
WINS Server 2	–	Secondary WINS server address	–
Host name & Services			
Desired Hostname	Enter the host name (15 character maximum). Factory default is model name and serial number.	Setting of the host name	–
Desired Description	Enter the service name (63 character maximum). Factory default is KIKUSUI XXXX Electronic Load (XXXX = model name) and serial number.	Setting of the mDNS service name	–
Dynamic DNS	Enable/Disable	Setting of dynamic DNS	✓
mDNS	Enable/Disable	Setting of multicast DNS	✓
NetBIOS Over TCP/IP	Enable/Disable	Setting of NetBIOS Over TCP/IP	✓
Auto Clock Adjustment			
NTP Server Hostname	ntp.nict.jp	NTP server address	–
Auto Adjustment	Enable/Disable	Setting of auto clock adjustment	–

Item	Value	Description	Reset
RS232C Settings			
Data Bitrate	9600/ 19200/ 38400/ 57600/ 115200	Baud rate	–
Data Bits	8 (fixed)	Data length	–
Stop Bits	1 (fixed)	Stop bits	–
Flow Control	None/ CTS-RTS	Flow control	–

Resetting the interface settings

Items that have a ✓ mark in the reset column in “List of setting items” *(p.91)* are returned to the factory default setting.

1 **Press SYSTEM, and then Interface.**
If the Configure screen does not appear, press Interface again.

2 **Press Modify, and then LAN Reset.**

3 **Press ENTER.**
The interface setting is reset.

Returning the interface settings to the factory default settings

1 **Press SYSTEM, and then press Interface.**
If the Configure screen does not appear, press Interface again.

2 **Press Modify, and then Default.**

3 **Press ENTER.**
The interface settings are returned to the factory default settings.

Displaying SCPI Errors

You can check the content of the SCPI error when an SCPI error occurs during remote control. Up to 16 errors are displayed. If the 17th error occurs, the 16th error changes to “-350 Queue overflow,” and subsequent errors do not occur.

1 **Press SYSTEM and then SCPI Error.**

The SCPI error is displayed. For details on errors, see the Communication Interface Manual on the included CD-ROM.

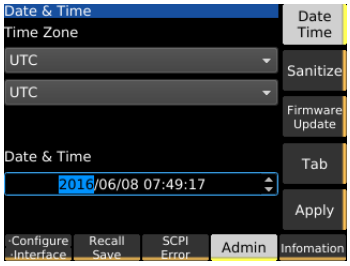
Pressing Clear or restarting the PLZ-5W will clear the error.

Setting the Date/Time

1 **Press SYSTEM, Admin and then Date Time.**

2 **Set the time zone and the date and time.**

Each time you press Tab, the item that you can set changes.



Purpose	Operation
Set the time zone (region name)	Press Tab to select the item in the top row of Time Zone, and then use the rotary knob to select the region name.
Set the time zone (city name)	Press Tab to select the item in the bottom row of Time Zone, and then use the rotary knob to select the city name.
Set the year, month, day, and time.	Press Tab to select the year, month, day, or time of Date & Time, and use the numeric keypad or rotary knob to enter the value.

3 **Press Apply.**

This completes the settings.

Factory Default Settings and Reset Settings

The PLZ-5W provides “factory default settings” and “reset settings” as default settings.

Restoring the factory default settings

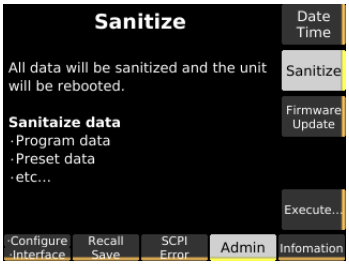
Restoring the factory default settings deletes all the user data*.

For details about the factory default setting, see “Main settings at factory default and at reset” *(p.95)*.

* The user data is deleted in accordance with the NISPOM (National Industrial Security Program Operating Manual) standard.

1 **Press SYSTEM, Admin, and then Sanitize.**

2 **Press Execute.**



3 **Use the rotary knob to select OK and then Press ENTER.**

The PLZ-5W is rebooted and the factory default settings are restored.

Restoring the reset settings

This operation returns some of the settings to their factory defaults.

Setting “RST” in “Panel settings at startup” *(p.88)* causes the PLZ-5W to restart with the reset settings the next time its power is turned on. For the items that are reset, see “Main settings at factory default and at reset” *(p.95)*.

Main settings at factory default and at reset

The main settings at factory default and at reset, for each of the settings that can be done with the SOURCE key, MEASURE key, SEQUENCE key, and SYSTEM key, are listed below.

All items that have the ✓ mark in the “Reset” column are returned to their factory default values upon reset.

Settings of the SOURCE function

Item		Factory default			Reset
		PLZ205W	PLZ405W	PLZ1205W	
Operation mode		CC			✓
Current		0 A			✓
Conductance		0 S			✓
Voltage		0 V			✓
Power		0 W			✓
Current range		H range			✓
Voltage range		H range			✓
Trigger source		Immediate			✓
Response speed in CR mode		Normal			✓
Response speed in CV mode		Normal			✓
Soft start time		OFF			✓
Auto load off timer		OFF			✓
External control	CC/CR/CP mode	Disable			✓
	CV mode	Disable			✓
	CC Add	Disable			✓
	Input Logic	Positive			✓
Switching	Current (Depth)	0 A			✓
	Conductance (Depth)	0 S			✓
	Duty cycle	50 %			✓
	Frequency	1 Hz			✓
Slew rate		0.01 A/µs	0.02 A/µs	0.06 A/µs	✓
Protection functions	Overcurrent protection setting	44 A	88 A	264 A	✓
	Operation at overcurrent protection activation	Limit			✓
	Overpower protection setting	220 W	440 W	1320 W	✓
	Operation at overpower protection activation	Limit			✓
	Undervoltage protection	OFF			✓
Short function		OFF			✓
Number of data points of I-V characteristics map		3			✓

Settings of the MEASURE function

Item		Factory default	Reset
Acquire function	Number of times measurement values are to be acquired (count)	1	✓
	Delay	0 s	✓
	Measurement interval function (Interval)	Disable	✓
	Measurement interval time (Interval Time)	0.1 s	✓
	Trigger source	Immediate	✓
	Sense aperture	0.1 s	✓
Data function	Integrated data recording period (Integral Gate)	Load On	✓
	Resetting of integrated data before start of recording (Reset)	Auto	✓
Integrated data display	Elapsed time	Disable	✓
	Capacity	Disable	✓
	Energy	Disable	✓

Settings of the SEQUENCE function

Item	Factory default	Reset
Program	No program	–
Program selection	No selection	✓

Settings of the SYSTEM function

Item		Factory default	Reset
Remote sensing		Disable	–
Panel settings at startup (Power On)		Resume	–
Watchdog protection function		Disable	–
Set time for watchdog protection function (Delay)		60 s	–
Screen saver		Disable	–
Screen saver startup time (Delay)		60 s	–
Key lock level		High	–
Beep sound	In case of invalid operation (Key)	Enable	–
	In case of protection activation	Enable	–
	In case of SCPI error	Enable	–
I/O direction of DIGITAL2 signal		Input	–
Time zone		UTC	–

For details on the factory default settings and reset settings for the interface, see “List of setting items” *(p.91)* in " Displaying/Changing the Interface Settings".

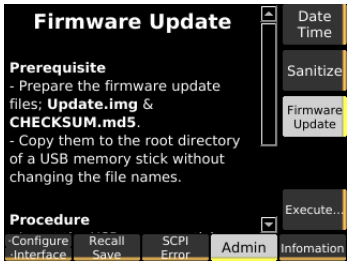
Updating

You can update the firmware of PLZ-5W by using a USB memory device.

If there is an update, you can obtain it from the download service on the Kikusui website (http://www.kikusui.co.jp/en/download/).

NOTE Save the update files (Update.img and CHECKSUM.md5) in the root directory of the USB memory device. Do not change the name of the update file.

1 **Press SYSTEM, Admin, and then Firmware Update.**



2 **Insert the USB memory device on which the update files have been saved into the USB port on the front panel, and then press Execute.**

An update screen appears.

3 **Press ENTER.**

Do not turn off the POWER switch while updating is in progress. Do not remove the USB memory device.

Updating is executed and the PLZ-5W restarts. After restart, remove the USB memory device.

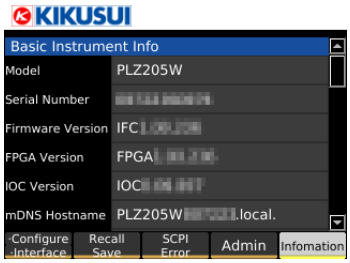
Updating is complete.

Displaying the Device Information

You can display the model name, serial number, firmware version, IP address and other device information.

1 **Press SYSTEM and then Information.**

The device information is displayed. You can scroll the screen by turning the rotary knob.



If a connection is established when IP Address > Method is set to Automatic in the interface settings *(p.91)* (the LAN connection status icon of the display is green), the automatically assigned IP address is displayed next IP Address.

8 Maintenance

Inspection

To purchase accessories or options, contact your Kikusui agent or distributor.

Cleaning the panels

If a panel needs cleaning, gently wipe it using a soft cloth with water-diluted neutral detergent.

⚠ CAUTION Do not use volatile chemicals such as benzene or thinner. They may discolor the surface, erase printed characters, cloud the display, and so on.

Overhaul

The electrolytic capacitors, fan motor, and battery for memory backup inside the PLZ-5W are consumable parts.

We recommend that you have the PLZ-5W overhauled every 10000 operating hours or so (the frequency depends on the usage conditions), along with internal inspection and cleaning. To have your unit overhauled, contact your Kikusui agent or distributor.

Backup battery replacement

The PLZ-5W has a battery inside. The battery's service life differs depending on the environment that the PLZ-5W is used in, but three years after it is purchased is a rough estimate for the battery's service life. When the battery is exhausted, the time becomes inaccurate. For information about replacing the battery, contact your Kikusui agent or distributor.

Calibration

The PLZ-5W is calibrated before shipment. To maintain long-term performance, we recommend periodic calibration. To have your PLZ-5W calibrated, contact your Kikusui agent or distributor.

Malfunctions and Causes

This section introduces troubleshooting measures that you can use if you notice problems during operation of the PLZ-5W. This section lists representative symptoms and the corresponding items that you can check, so find the item that matches your situation. In some cases, the problem can be solved quite easily.

If you can find an item that matches your situation, follow the remedies that are listed. If following these measures does not solve the problem, or if none of the items listed here match your situation, contact your Kikusui agent or distributor.

■ Nothing appears on the display when the POWER switch is turned on.

Check item	Check result	Possible cause	Remedy
Is the rated voltage being applied to the input power supply (AC)?	No	Broken power cord Bad connection at the AC. INPUT connector on the rear panel.	Check that the power cord is not broken and that the connection at the AC INPUT connector is secure.
	Yes	The product is malfunctioning.	Remove the power cord plug from the outlet. Immediately stop using the PLZ-5W, and have it repaired.

■ Keys do not work.

Check item	Check result	Possible cause	Remedy
Are the keys locked? (🔒1/🔒2/🔒3 is shown on the display)	Yes	The key lock is enabled.	Hold down ENTER to unlock the keys.
	No	The product is malfunctioning.	Immediately stop using the PLZ-5W, and have it repaired.

■ Input current is unstable or oscillates.

Check item	Check result	Possible cause	Remedy
Is the rated voltage being applied to the input power supply (AC)?	No	Low supply voltage.	Use the PLZ-5W in the input supply voltage range.
	Yes	The product is malfunctioning.	Immediately stop using the PLZ-5W, and have it repaired.
Is an alarm occurring?	Yes	An internal or external error occurred on the PLZ-5W.	Check the type of alarm, and eliminate the root cause of the alarm. *(p.32)*.
Is there a large loop in the load cable?	Yes	The wire inductance has increased.	Twist the wires. See “Preventing large voltage variation when load current changes suddenly” *(p.111)*.
Does the behavior change depending on the length of the wiring?	Yes	A proper response speed is not being used.	Change the response speed *(p.42)*.

■ An alarm is occurring.

Check item	Check result	Possible cause	Remedy
Has the fan stopped?	Yes	The overheat protection has been activated.	Immediately stop using the PLZ-5W, and have it repaired.
Are the vent or inlet holes blocked?	Yes	The overheat protection has been activated.	Move the product so that there is at least 20 cm of space between the vents and the surrounding walls. Do not place objects within 20 cm of the vents.
Has overcurrent protection (OCP) been activated?	Yes	The OCP setting is small.	Set an appropriate OCP value on the setup screen *(p.32)*.
Has overpower protection (OPP) been activated?	Yes	The OPP setting is small.	Set a larger OPP value on the setup screen *(p.32)*.

■ The load cannot be turned on.

Check item	Check result	Possible cause	Remedy
A sequence is in operation	Yes	The load cannot be turned on manually when a sequence is in operation.	Wait for the sequence operation to finish. Abort the sequence by pressing Abort *(p.70)*.
	No	The load on/off logic (Input Logic) is set to Negative.	Set “Input Logic” to “Positive.” *(p.78)*
Are you using an external signal to turn the load off?	Yes	When the load is turned off through external control, the LOAD key is invalid.	The load key will be valid after you use an external signal to turn the load on *(p.78)*.

■ External control (CC/CR/CP) cannot be set.

Check item	Check result	Possible cause	Remedy
The switching function is on.	Yes	Cannot be used simultaneously with the switching function.	Turn off the switching function *(p.31)*.
The short function is on.	Yes	Cannot be used simultaneously with the short function.	Turn off the short function *(p.28)*.

■ The switching function cannot be set

Check item	Check result	Possible cause	Remedy
External control (CC/CR/CP) is on.	Yes	Cannot be used simultaneously with the external control (CC/CR/CP).	Turn off the external control (CC/CR/CP) *(p.75)*.
The short function is on.	Yes	Cannot be used simultaneously with the short function.	Turn off the short function *(p.28)*.

■ Short function cannot be set.

Check item	Check result	Possible cause	Remedy
The switching function is on.	Yes	Cannot be used simultaneously with the switching function.	Turn off the switching function *(p.31)*.
External control (CC/CR/CP) is on.	Yes	Cannot be used simultaneously with the external control (CC/CR/CP).	Turn off the external control (CC/CR/CP) *(p.75)*.

9 Specifications

Unless specified otherwise, the specifications are for the following settings and conditions.

- The product is warmed up for at least 30 minutes (with current flowing).
- TYP: These are typical values that are representative of situations where the product operates in an environment with an ambient temperature of 23 °C. They are not guaranteed performance values.
- set: Indicates a setting.
- range: Indicates the rated value of each range.
- reading: Indicates a reading.
- The specifications of the PLZ-5W are for the load input terminals on the rear panel.

Ratings

Item	PLZ205W	PLZ405W	PLZ1205W
Operating voltage (DC)[1]	1 V ~ 150 V[2]		
Current	40 A	80 A	240 A (80 A[3] for the load input terminals on the front panel)
Power	200 W	400 W	1200 W
Input resistance when the load is off	Approx. 660 kΩ[4]		
Load input terminal's isolation voltage	±500 V		

1 The minimum operating voltage at which current begins to flow through the PLZ-5W is approximately 0.05 V. At the load input terminals on the rear panel.
2 In switching mode, for every slew rate setting of 1 A/µs, the minimum operating voltage (including the voltage drop due to the wiring inductance component) increases by approximately 150 mV for the PLZ205W, 125 mV for the PLZ405W, and 75 mV for the PLZ1205W.
3 The specifications of the PLZ-5W are for the load input terminals on the rear panel and the load input terminals on the front panel may not meet the specifications.
4 In the case of parallel operation using the same models, approx. 660/number of units kΩ.

Constant current (CC) mode

Item			PLZ205W	PLZ405W	PLZ1205W
Operating range		H range	0 A ~ 40 A	0 A ~ 80 A	0 A ~ 240 A
		M range	0 A ~ 4 A	0 A ~ 8 A	0 A ~ 24 A
		L range	0 A ~ 0.4 A	0 A ~ 0.8 A	0 A ~ 2.4 A
Setting range		H range	0 A ~ 42 A	0 A ~ 84 A	0 A ~ 252 A
		M range	0 A ~ 4.2 A	0 A ~ 8.4 A	0 A ~ 25.2 A
		L range	0 A ~ 0.42 A	0 A ~ 0.84 A	0 A ~ 2.52 A
Resolution		H range	1 mA	2 mA	5 mA
		M range	0.1 mA	0.2 mA	0.5 mA
		L range	0.01 mA	0.02 mA	0.05 mA
Setting accuracy		H range	±(0.2 % of set + 0.1 % of range)		
		M range	±(0.2 % of set + 0.3 % of range)		
		L range	±(0.2 % of set + 1 % of range)		
	Parallel operation	H range	±(0.4 % of set + 0.8 % of range)		
		M range	±(0.4 % of set + 0.8 % of range)		
		L range	±(0.4 % of set + 5 % of range)		
Input line regulation[1]			4 mA	8 mA	24 mA
Ripple		rms[2]	4 mA	8 mA	24 mA
		p-p[3]	40 mA	80 mA	200 mA

1 When the input voltage is changed from 1 V to 150 V at a current of rated power/150 V.
2 Measurement frequency bandwidth: 10 Hz to 1 MHz
3 Measurement frequency bandwidth: 10 Hz to 20 MHz

Constant resistance (CR) mode

Item		PLZ205W	PLZ405W	PLZ1205W
Operating range[1]	H range	40 S to 0.002 S (0.025 Ω to 500 Ω)	80 S to 0.004 S (0.0125 Ω to 250 Ω)	240 S to 0.012 S (0.0042 Ω to 83.333 Ω)
	M range	4 S to 0.0002 S (0.25 Ω to 5000 Ω)	8 S to 0.0004 S (0.125 Ω to 2500 Ω)	24 S to 0.0012 S (0.042 Ω to 833.33 Ω)
	L range	400 mS to 0.02 mS (2.5 Ω to 50000 Ω)	800 mS to 0.04 mS (1.25 Ω to 25000 Ω)	2400 mS to 0.12 mS (0.42 Ω to 8333.3 Ω)
Setting range	H range	42 S to 0 S (0.0238Ω to Open)	84 S to 0 S (0.0119Ω to Open)	252 S to 0 S (0.00397Ω to Open)
	M range	4.2 S to 0 S (0.238Ω to Open)	8.4 S to 0 S (0.119Ω to Open)	25.2 S to 0 S (0.0397Ω to Open)
	L range	420 mS to 0 S (2.38Ω to Open)	840 mS to 0 S (1.19Ω to Open)	2520 mS to 0 S (0.397Ω to Open)
Resolution	H range	1 mS	2 mS	5 mS
	M range	0.1 mS	0.2 mS	0.5 mS
	L range	0.01 mS	0.02 mS	0.05 mS
Setting accuracy[2]	H range	±(0.5% of set + 0.5% of range)		
	M range	±(0.5% of set+ 0.5% of range)		
	L range	±(0.5% of set + 1.5% of range)		
Parallel operation	H range	±(0.5% of set + 1.5% of range)		
	M range	±(0.5% of set+ 1.5% of range)		
	L range	±(0.5% of set + 5% of range)		

1 Conductance [S] = input current [A]/input voltage [V] = 1/resistance [Ω]
2 Converted value at the input current. At the connectors.

Constant voltage (CV) mode

Item		PLZ205W	PLZ405W	PLZ1205W
Operating range	H range	1 V to 150 V		
	L range	1 V to 15 V		
Setting range	H range	0 V to 157.5 V		
	L range	0 V to 15.75 V		
Resolution	H range	5 mV		
	L range	0.5 mV		
Setting accuracy[1]		±(0.1 % of set + 0.1 % of range)		
	Parallel operation	±(0.2 % of set + 0.2 % of range)		
Input current variation[2]		12 mV		

1 With the input voltage within the operating range, and at the connector during remote sensing.
2 For a current change in the range of 10 % to 100 % of the rating at an input voltage of 5 V (during remote sensing).

Constant power (CP) mode

Item		PLZ205W	PLZ405W	PLZ1205W
Operating range	H range	20 W to 200 W	40 W to 400 W	120 W to 1200 W
	M range	2 W to 20 W	4 W to 40 W	12 W to 120 W
	L range	0.2 W to 2 W	0.4 W to 4 W	1.2 W to 12 W
Setting range	H range	0 W to 210 W	0 W to 420 W	0 W to 1260 W
	M range	0 W to 21 W	0 W to 42 W	0 W to 126 W
	L range	0 W to 2.1 W	0 W to 4.2 W	0 W to 12.6 W
Resolution	H range	0.005 W	0.01 W	0.05 W
	M range	0.0005 W	0.001 W	0.005 W
	L range	0.00005 W	0.0001 W	0.0005 W
Setting accuracy[1]	H range	±(0.5% of range + 0.04 A × Vin)	±(0.5% of range + 0.08 A × Vin)	±(0.5% of range + 0.24 A × Vin)
	M range	±(0.5% of range + 0.008 A × Vin)	±(0.5% of range + 0.016 A × Vin)	±(0.5% of range + 0.048 A × Vin)
	L range	±(1% of range + 0.004 A × Vin)	±(1% of range + 0.008 A × Vin)	±(1% of range + 0.024 A × Vin)
Parallel operation	H range	±(2% of range + 0.4% current range × Vin)		
	M range	±(2% of range + 0.4% current range × Vin)		
	L range	±(2% of range + 2.5% current range × Vin)		

1 Vin: The voltage at the load input terminals on the rear panel or sensing connectors.

Arbitrary I-V characteristics (ARB) mode

Voltmeter

Item	PLZ205W	PLZ405W	PLZ1205W
Operating range	Three to 100 points of current values can be set for the input voltage. The space between two points is linearly interpolated.		
Response speed	Response for input voltage max 50us.		

Measurement function

Voltmeter

Item		PLZ205W	PLZ405W	PLZ1205W
Display	H range	0.00 V to 150.00 V		
	L range	0.000 V to 15.000 V		
Accuracy		±(0.1% of reading + 0.1% of range)		
	Parallel operation (TYP)	±(0.1% of reading + 0.1% of range)		

Ammeter

Item		PLZ205W	PLZ405W	PLZ1205W
Display	H range	0.000 A to 40.000 A	0.000 A to 80.000 A	0.00 A to 240.00 A
	M range	0.0000 A to 4.0000 A	0.0000 A to 8.0000 A	0.000 A to 24.000 A
	L range	0.00 mA to 400.00 mA	0.00 mA to 800.00 mA	0.0000 A to 2.4000 A
Accuracy	H range, M range	±(0.2 % of reading + 0.3 % of range)		
	L range	±(0.2 % of reading + 1 % of range)		
Parallel operation (TYP)	H range, M range	±(0.4 % of reading + 0.8 % of range)		
	L range	±(0.4 % of reading + 5 % of range)		

Power display

Item	PLZ205W	PLZ405W	PLZ1205W
Display	Displays the product of the voltmeter reading and ammeter reading.		

Switching function

Item		PLZ205W	PLZ405W	PLZ1205W
Operation mode		CC and CR		
Frequency setting range		1.0 Hz to 100.0 kHz		
Frequency setting resolution	1 Hz to 10 Hz	0.1 Hz		
	11 Hz to 100 Hz	1 Hz		
	110 Hz to 1000 Hz	10 Hz		
	1.1 kHz to 10.0 kHz	0.1 kHz		
	10 kHz to 100 kHz	20 kHz, 50 kHz, 100 kHz		
Frequency setting accuracy		±(0.5 % of set)		
Duty cycle setting range, step[1]	1 Hz to 10 Hz	5.0 % to 95.0 %, 0.1 % steps		
	11 Hz to 100 Hz			
	110 Hz to 1000 Hz			
	1.1 kHz to 10.0 kHz	5 % to 95 %, 1 % steps		
	10 kHz to 100 kHz	10 % to 90 %, 10 % steps		

1 The minimum time span is 5 us. The minimum duty cycle is limited by the minimum time span.

Slew rate

Item		PLZ205W	PLZ405W	PLZ1205W
Operation mode		CC		
Setting range	H range	0.01 A/µs to 10 A/µs	0.02 A/µs to 20 A/µs	0.06 A/µs to 60 A/µs
	M range	0.001 A/µs to 1 A/µs	0.002 A/µs to 2 A/µs	0.006 A/µs to 6 A/µs
	L range	0.1 mA/µs to 100 mA/µs	0.2 mA/µs to 200 mA/µs	0.6 mA/µs to 600 mA/µs
Resolution	H range	0.01 A/µs	0.02 A/µs	0.06 A/µs
	M range	0.001 A/µs	0.002 A/µs	0.006 A/µs
	L range	0.1 mA/µs	0.2 mA/µs	0.6 mA/µs
Setting accuracy[1]	H range, M range	±(10 % of set +1.25 µs)		
	L range	±(12 % of set +5 µs)		

1 The time it takes to shift from 10% to 90% when the current is varied from 0% to 100% of the rated current.

Soft start

Item	PLZ205W	PLZ405W	PLZ1205W
Operation mode	CC		
Time setting range	100 µs, 200 µs, 500 µs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, or off		
Time setting accuracy	±(30 % of set +10 µs)		

Alarm Feature

Alarm 1

Item	PLZ205W	PLZ405W	PLZ1205W
Overvoltage detection	Turns off the load when 110 % or higher of the range rating voltage is applied.		
Reverse-connection detection	Turns off the load when a reverse voltage (-0.6 V) is applied to the load input terminals or when a reverse current (approx. -1% of range rating) flows.		
Overheat detection	Turns off the load when the heatsink temperature reaches 100 °C.		
Alarm input detection	Turns off the load when a voltage between 0 V and 1.5 V is applied to ALARM INPUT (pin 10) of the EXT CONT connector.		
Parallel operation anomaly detection	Turns off the load when an anomaly occurs during communication during parallel operation, the power of a slave unit is interrupted, or detection of overheating of slave unit.		
Front-panel load input terminal overcurrent detection	A current of 80 A or higher flowed through the front panel load input terminals.		

Alarm 2

Item		PLZ205W	PLZ405W	PLZ1205W
Overcurrent protection (OCP)	Setting range	0.0 A to 44.0 A	0.0 A to 88.0 A	0.0 A to 264.0 A
	Resolution	0.1 A	0.2 A	0.5 A
	Protection operation	Either load off or limitation can be selected.		
Overpower protection (OPP)	Setting range	0 W to 220 W	0 W to 440 W	0 W to 1320 W
	Resolution	1 W	2 W	5 W
	Protection operation	Either load off or limitation can be selected.		
Undervoltage protection (UVP)	Setting range	0.00 V to 150.00 V, or off		
	Resolution	0.01 V		
	Protection operation	Load off		
Watchdog protection (WDP)	Setting range	60 s to 3600 s, or off		
	Protection operation	Load off		

Sequence function

Item	PLZ205W	PLZ405W	PLZ1205W
Operation mode	CC, CR, CV, CP		
Maximum number of programs	30		
Maximum number of steps	10000		
Step execution time	25 µs to 1000 h		
Time resolution	25 µs		

Other functions

Item		PLZ205W	PLZ405W	PLZ1205W
Possible remote sensing compensation voltage		approx. 7 V (Total potential difference between the input terminals and sensing connectors)		
Number of units in parallel operation	Same model	5 units	5 units	5 units
	Booster	–	–	PLZ1205W: 1 unit PLZ2405WB: 4 units
Mutual synchronized operation		Synchronization of load on/off, measurements, sequence execution, and sequence resumption.		
Elapsed time display		Displays the time from load on to load off.		
	Range	1 s to 999 h 59 min 59 s.		
Integrated current display		Displays integrated current from load on to load off.		
Integrated power display		Displays integrated power from load on to load off.		
Auto load off timer		Automatically turns off the load after the specified time elapses.		
	Setting range	1 s to 3599999 s, or off.		

Common specifications

EXT CONT connector

Item		Specifications
Load on/off control input		Logic level switchable. Pulled up to 5 V by a 10 kΩ resistor. The thresholds are HIGH: 3.5 V to 5 V, LOW: 0 V to 1.5 V.
Range control input		The range can be switched between L, M, and H using a 2 bit signal. Pulled up to 5 V by a 10 kΩ resistor. The thresholds are HIGH: 3.5 V to 5 V, LOW: 0 V to 1.5 V.
Alarm input		An alarm is activated with a voltage between 0 V and 1.5 V. Pulled up to 5 V by a 10 kΩ resistor. The thresholds are HIGH: 3.5 V to 5 V, LOW: 0 V to 1.5 V.
Alarm clearing input		After an alarm occurs, eliminate the root cause of the alarm, and change the input to pin 5 of the EXT CONT connector from a low level signal to a high level signal. The alarm will be cleared on the rising edge of this signal. Pulled up to 5 V by a 10 kΩ resistor. The thresholds are HIGH: 3.5 V to 5.0 V, LOW: 0 V to 1.5 V.
Trigger input		Paused sequence operation resumes when a voltage between 0 V and 0.8 V is received. Pulled up to 5 V by a 10 kΩ resistor. The thresholds are HIGH: 2 V to 5 V, LOW: 0 V to 0.8 V.
External voltage control input (CC, CR, CP mode)		Controls the load settings of CC, CR, CP mode through external voltage input. The input impedance is approx. 10 kΩ. CC: The setting can be controlled in the range of 0 % to 100 % of the rated current through external voltage input of 0 V to 10 V. CR: The setting can be controlled in the range of 0 % to 100 % of the conductance setting through external voltage input of 0 V to 10 V. CP: The setting can be controlled in the range of 0 % to 100 % of the rated power through external voltage input of 0 V to 10 V.
	Setting accuracy	±(1 % of range) (TYP value of H range in CC mode)
External voltage control input (CV mode)		The load setting of CV mode can be controlled through external voltage input. The rated voltage can be controlled in the range of 0 % to 100 % with 0 V to 10 V. The input impedance is approx. 10 kΩ.
	Setting accuracy	±(1 % of range) (TYP value)
External voltage control input (superimposing in CC mode)		Controls the load setting of CC mode by adding current through external voltage input. Adds current in the range of -100% to 100% of the rated current for -10 V to 10 V. The input impedance is approx. 10 kΩ.
	Setting accuracy	±(1 % of range) (TYP value of H range)
Load-on status output		On when load is on. Open-collector output from a photocoupler.[1]
Range status output		Outputs current range state L, M, and H using 2 bits. Open-collector output from a photocoupler.[1]

Item	Specifications
ALARM 1 output	ON when overvoltage detection, reverse-connection detection, overheat detection, alarm input detection, front-panel load terminal overcurrent detection or parallel operation anomaly detection is activated. Open-collector output from a photocoupler.[1]
ALARM 2 output	On when OCP, OPP, UVP, or WDP is operating.
DIGITAL 0 output	Logic signal output during a step of a sequence. Output impedance: approx. 330 Ω, output voltage: approx. 3.3 V_{EMF}
DIGITAL 1 output	
DIGITAL 2 output	Can be switched between input and output. Output: Logic signal output during a step of a sequence. The output impedance is 330 Ω. Input: This signal is the trigger input signal for the sequence and the measurement functions. The thresholds are HIGH: 2 V to 5 V, LOW: 0 V to 0.8 V.
Current monitor output	Outputs 0 V to 10 V for 0 % to 100 % of the rated current of each range.
Accuracy	±(1 % of range) (TYP value of H range)
Short signal output	Relay contact on when the short function is turned on (30 Vdc/1 A).

1 The maximum voltage that can be applied to the photocoupler is 30 V. The maximum current is 4 mA.

Front-panel BNC terminal

Item	Specifications
Trigger output	Transmits 10 µs pulses when trigger output is ON during sequence operation and during step execution. Transmits 1 µs pulses during switching operation. Output impedance: 200 Ω, output voltage: approx. 5 V_{EMF}
Current monitor output	Outputs 0 V to 2 V for 0 % to 100 % of the rated current of each range.
Accuracy	±(1 % of range) (TYP value of H range)
Isolation voltage	±30 V

Communication function

Item		Specifications
RS232C	Hardware	D-SUB 9-pin connector Baud rate: 9600, 19200, 38400, 115200 bps Data length: 8 bits, Stop bits: 1 bit, Parity bit: None, Flow control: None, CTS-RTS
	Message terminator	LF during reception, LF during transmission.
USB (device)	Hardware	Standard type B socket. Complies with the USB 2.0 specification. Data rate: 480 Mbps (High speed)
	Message terminator	LF or EOM during reception, LF + EOM during transmission.
	Device class	Complies with the USBTMC-USB488 device class specifications.
USB (host)	Hardware	Standard type A socket. Complies with the USB 2.0 specifications. Data rate: 12 Mbps (Full speed)
LAN	Hardware	IEEE 802,3 100Base-TX/10Base-T Ethernet Auto-MDIX support IPv4, RJ-45 connector
	Conforming standard	Complies with LXI 1.4 Core Specification 2011.
	Communication protocol	VXI-11, HiSLIP, SCPI-RAW, SCPI-Telnet
	Message terminator	VXI-11, HiSLIP: LF or END during reception, LF + END during transmission SCPI-RAW: LF during reception, LF during transmission

General specifications

Item		PLZ205W	PLZ405W	PLZ1205W
Input voltage range		100 Vac to 240 Vac (90 Vac to 250 Vac) single phase, continuous		
Input frequency range		47 Hz to 63 Hz		
Power consumption		50 VAmax	50 VAmax	85 VAmax
Inrush current (peak value)		45 A		
Environmental conditions	Operating temperature range	0 °C to 40 °C (32 °F to 104°F)		
	Operating humidity range	20 %rh to 85 %rh (no condensation)		
	Storage temperature range:	-20 °C to 70 °C (-4 °F to 158°F)		
	Storage humidity range:	90 %rh or less (no condensation)		
	Installation location	Indoor use, altitude of up to 2000 m, overvoltage category II.		
Insulation resistance	Between primary and input terminals	500 Vdc, 30 MΩ or more (70 %rh or less)		
	Between primary and chassis			
	Between input terminals and chassis			
Withstanding voltage	Between primary and input terminals	No abnormalities at 1500 Vac for 1 minute.		
	Between primary and chassis	No abnormalities at 1500 Vac for 1 minute.		
	Between input terminals and chassis	No abnormalities at 750 Vac for 1 minute.		
Dimensions		See *(p.109)*		
Weight		Approx. 7 kg (15.4 lb.)	Approx. 7.5 kg (16.5 lb.)	Approx. 14 kg (30.9 lb.)
Accessories		See *(p.3)*		
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]) EN 61000-3-2 EN 61000-3-3 Applicable under the following conditions. The maximum length of all cabling and wiring connected to the PLZ-5W must be less than 3 m.		
Safety[1]		Complies with the requirements of the following directive and standards. EMC Directive 2014/35/EU[2] EN 61010-1 (Class I[5], Pollution Degree 2[6])		

1 Does not apply to specially ordered or modified PLZ-5Ws.

2 Limited to products that have the CE mark on their panels.

3 This is a Class A equipment. 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.

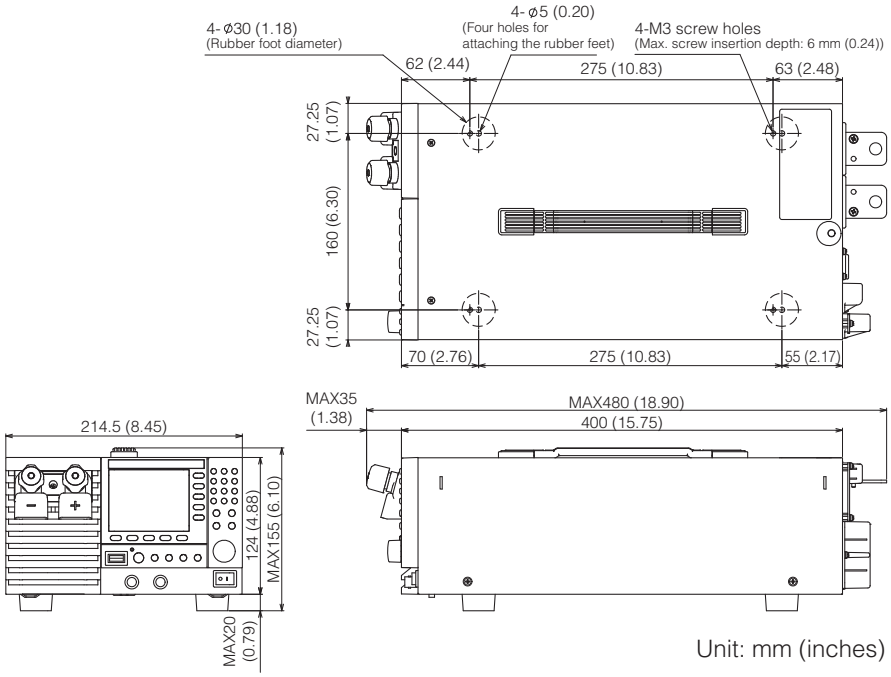
4 This is a Group 1 equipment. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purpose.

5 This is a Class I equipment. Be sure to ground this product's protective conductor terminal. The safety of this product is only guaranteed 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.

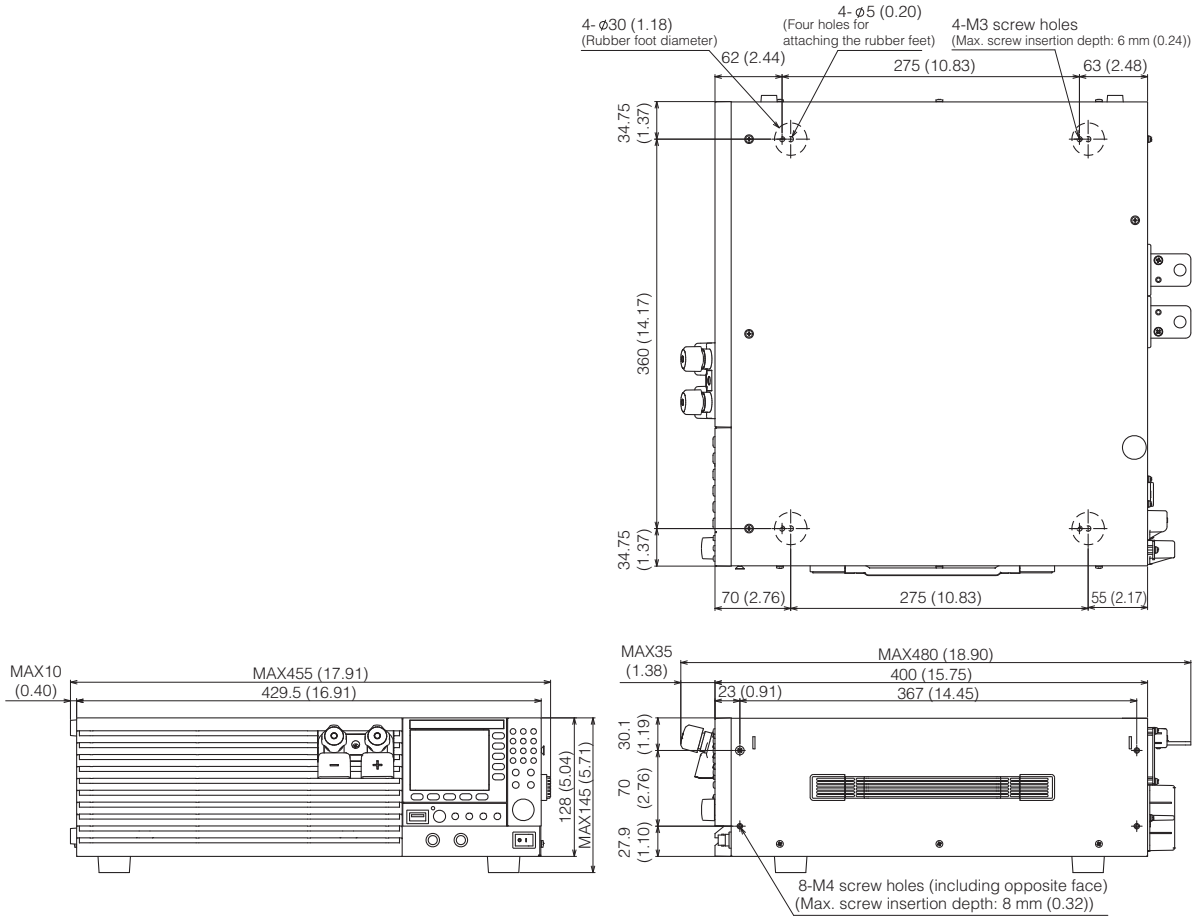
External dimensions

PLZ205W, PLZ405W



Unit: mm (inches)

PLZ1205W



Unit: mm (inches)

10 Appendix

Selecting the Load Cables

⚠ WARNING

- **Risk of fire. Use load cables whose capacity is adequate for the PLZ-5W's rated output current.**
- **Risk of electric shock. Use load cables with a voltage rating that meets or exceeds the isolation voltage (±500 V) of the PLZ-5W's load input terminals.**

⚠ CAUTION

- Use load cables with a core diameter that is appropriate for the amount of current being used and with sturdy, flame-resistant insulation.

■ Current capacity of load cables

If the wiring that you use for the load has a high resistance, the voltage will drop significantly when current flows, and the voltage at the load input terminals may fall below the minimum operating voltage of the PLZ-5W. 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](Ta = 30 °C)	Kikusui-Recommended Current [A]
14	6	(13.3)	88	50
22	4	(21.15)	115	80
30	2	(33.62)	139	-
38	1	(42.41)	162	100
50	1/0	(53.49)	190	-
60	2/0	(67.43)	217	-
80	3/0	(85.01)	257	200
100	4/0	(107.2)	298	-
125	-	-	344	-
150	-	-	395	300
200	-	-	469	-
250	-	-	556	-
325	-	-	650	-

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.

■ Limitations of the remote sensing function

All wires have resistance. As the wire becomes longer or the current becomes larger, the voltage drop in the wire becomes greater. This results in a smaller voltage being applied at the load input terminal.The PLZ-5W has a sensing function *(p.44)* that compensates for this voltage drop, which is the total potential difference between the load input terminals and sensing connectors, by up to approximately 7 V. If the voltage drop exceeds this level, use wires that have a greater cross-sectional area.

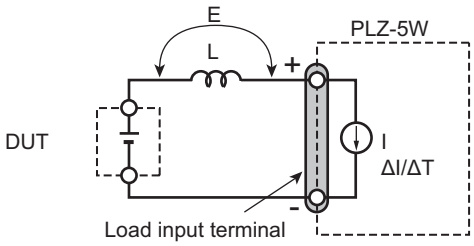
Methods to Stabilize Operation

Using the PLZ-5W with fast response speed may cause instable oscillation or other operation instability. To achieve stabilization, the load cable inductance must be reduced and an appropriate response speed must be set.

Reducing the load cable inductance

Relationship between voltage induction when current is changed and inductance

Load cables have inductance L. If current I changes quickly, a large voltage is induced on both ends of the installed cables. If the impedance of the DUT is small, this voltage is entirely applied to the load input terminals of the electronic load. The load cable's inductance L and voltage E that is induced according to the changes in current I (hereafter referred to as the induced voltage) are expressed by the following expression:



$$E = L \times (\Delta I / \Delta T)$$

E Induced voltage
L Wiring inductance
ΔI Change in current
ΔT Duration of time over which the current c

Generally, a cable's inductance is 1 µH per meter of cable. If 1 meter of cable (cumulative length of positive (+) polarity cable and negative (−) polarity cable) is used as the load cable between the DUT and electronic load, and the current change is 50 A/µs, the induced voltage is 50 V.

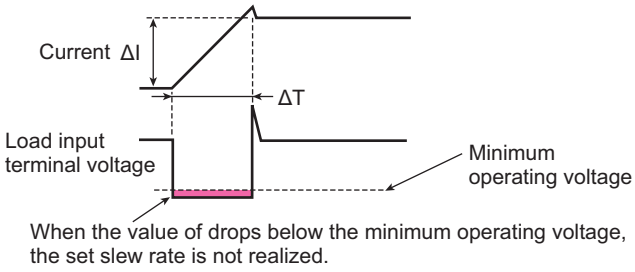
The negative (−) polarity of the load input terminals is the reference potential of the external control signal. Devices connected to external control terminals may malfunction due to the induced voltage.

In constant voltage mode, constant resistance mode, and constant power mode, the load current is varied by the voltage at the load input terminals. This causes the operation to be easily affected by induced voltage.

Preventing large voltage variation when load current changes suddenly

Use the shortest cables possible to connect the PLZ-5W and DUT, and twist the cables. If the load cable is long or has a large loop, the inductance of the wiring will be increased and large voltage variation will occur owing to current changes when the load current changes suddenly.

When the value of instantaneous voltage of the load input terminals drops below the minimum operating voltage, the set slew rate is not realized. You must be careful especially when the slew rate setting is high or when changing the load rapidly using large current.

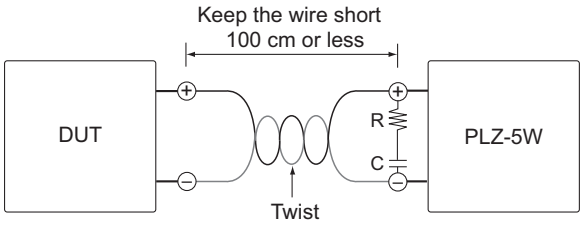


Either make the wiring as short as possible so as to keep the voltage resulting from inductance equal to or higher than the minimum operating voltage and within the maximum input voltage range of the PLZ-5W, or reduce the set slew rate. If it is not necessary to operate at a high response speed, reduce the slew rate or reduce the response speed in CC mode or CR mode.

Reducing oscillation caused by phase lag of the current

In CR mode, CV mode, and CP mode, phase lag of the current may cause control of the PLZ-5W to become unstable and oscillation phenomena to occur, even during DC operation. Therefore, use the shortest cables possible and twist them.

If only DC operation is required, a capacitor and a resistor may be connected to the load input terminal to reduce oscillation. Use the capacitor within its allowable ripple current.



Example: R=10 Ω, C=100 µF

Optimizing the response speed

The current phase is delayed with respect to the voltage due to the inductance of the wiring. Control of the PLZ-5W may become unstable and oscillation phenomena may occur.

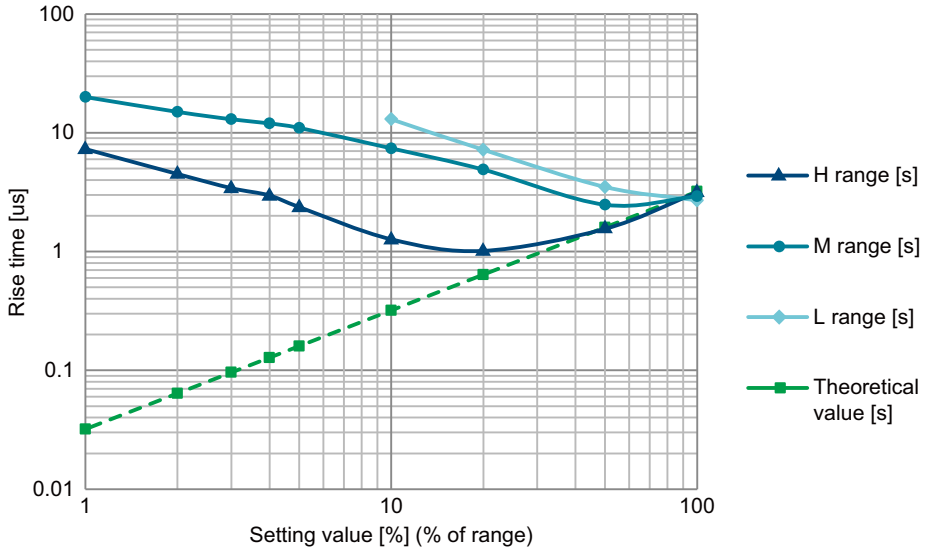
If, in CV mode or CR mode, the response speed is set to Fast, stable operation can be secured by setting the response speed to Normal *(p.42)*.

Using remote sensing

Remote sensing *(p.44)* can be used to stabilize load current. In CP mode, the response speed cannot be specified, but the operation can be stabilized by using remote sensing.

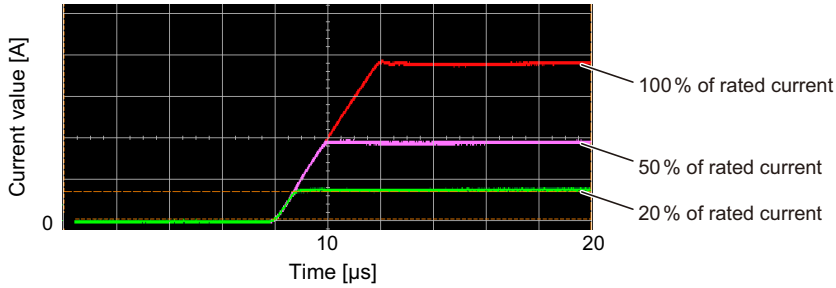
Slew Rate for Small Currents

If the load current is made small in current (CC) mode, the specified slew rate may not be achieved. The following graph shows the current settings verses the logical current rise times and actual current rise times when the slew rate is set to the maximum value in each range.

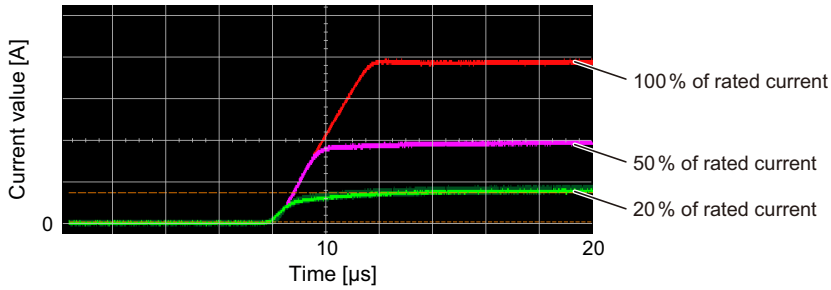


Furthermore, the following graphs show the relationship between the current value and change in current when the slew rate is set to the maximum value for each range.

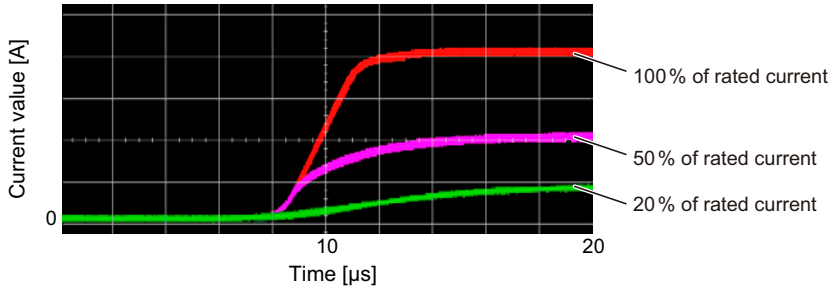
■ H range



■ M range



■ L range

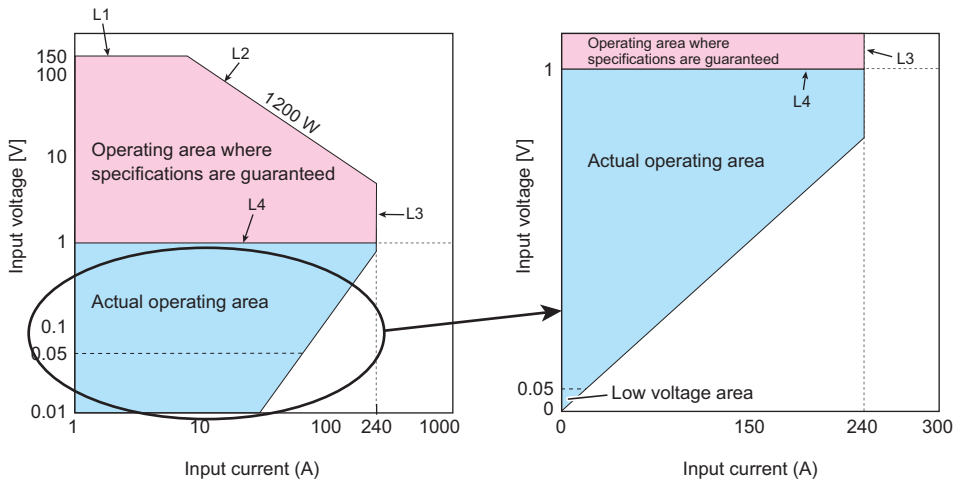


Operating Area

As shown in the figure, the PLZ-5W can be used within the area enclosed by the constant voltage line according to the rated voltage (L1), the constant power line according to the rated power (L2), the constant current line according to the rated current (L3), and the constant voltage line according to the minimum operating voltage (L4) (operating area where the specifications are guaranteed). The specifications are guaranteed at input voltages of 1 V and greater, but by reducing the current, operation is possible even with input voltages of less than 1 V (actual operating area). However, the specifications are not guaranteed in that case.

The voltage at which current starts flowing to the PLZ-5W is approximately 50 mV. If the input voltage is gradually increased from 0 V, no current will flow until the voltage exceeds approximately 50 mV. If the input voltage exceeds approximately 50 mV and a current greater than or equal to 1 % (greater than or equal to 1 % of the H range when the PLZ-5W is set using the M range) starts flowing, the current can be kept flowing even when the input voltage is reduced.

For the operating range of each model, refer to “Operating Area of Each Model” *(p.124)*.

PLZ1205W H range Operating area	

Basic operation modes

The following five operation modes are available on the PLZ-5W.

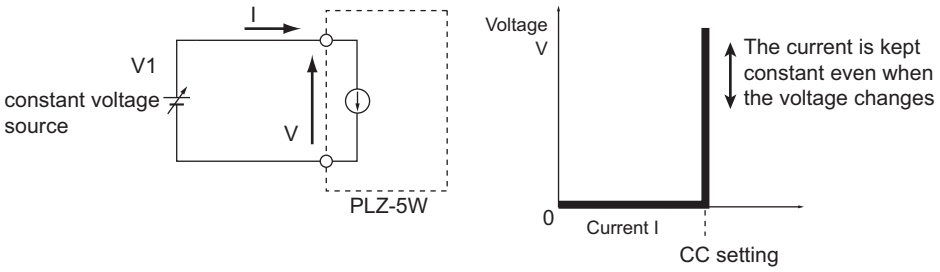
- Constant current mode (CC mode)
- Constant resistance mode (CR mode)
- Constant power mode (CP mode)
- Constant voltage mode (CV mode)
- Arbitrary I-V characteristics mode (ARB mode)

Operation of the constant current (CC) mode

In CC mode, the current is kept constant even when the voltage changes.

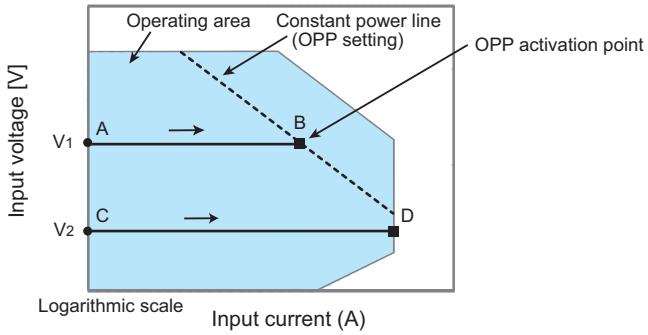
Operation of the constant current mode

When the PLZ-5W is used in CC mode, the PLZ-5W operates as a constant current load as shown in the following figure. The PLZ-5W continues to deliver the specified current I even when the power supply's output voltage V1 changes.



Transition of the operating point: Overpower protection (OPP) operation

Example: Examining the load characteristics of the constant-voltage power supply in CC mode.



■ Operation on segment AB

If the voltage of the constant-voltage power supply is set to V1 and the input current (load current) of the PLZ-5W is increased, the operating point moves along segment AB.

When point B is reached, overpower protection (OPP) is activated. At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OPP detection.

If the action set to be executed at OPP detection is Trip, load off is executed.

If the action set to be executed at OPP detection is Limit, the PLZ-5W sinks current as a constant power load at point B. Even if you attempt to increase the input current, the current is limited at point B. If you decrease the input current, the OPP is cleared. The PLZ-5W returns to CC mode and the operating point moves along segment AB.

Point B	Trip	Turns off the load (stops the current flow). The PLZ-5W no longer operates as a load.
	Limit	CC mode ends. OPP continues, and the PLZ-5W sinks current as a constant power load.

■ Operation on segment CD

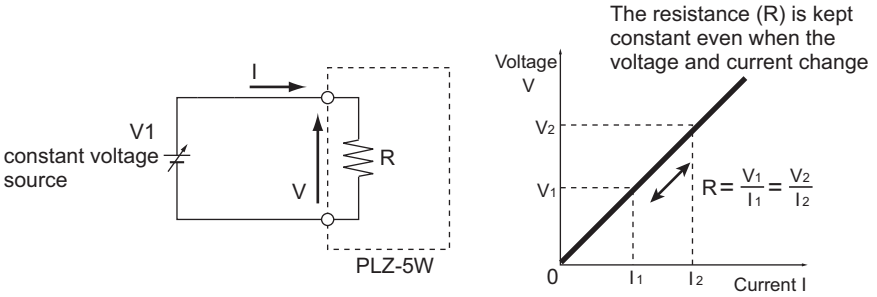
If the voltage of the constant-voltage power supply is set to V2 and the input current (load current) of the PLZ-5W is increased, the operating point moves along segment CD. Point D is the maximum current at the range being used.

Operation in constant resistance (CR) mode

In CR mode, the PLZ-5W sinks current proportional to the voltage variation.

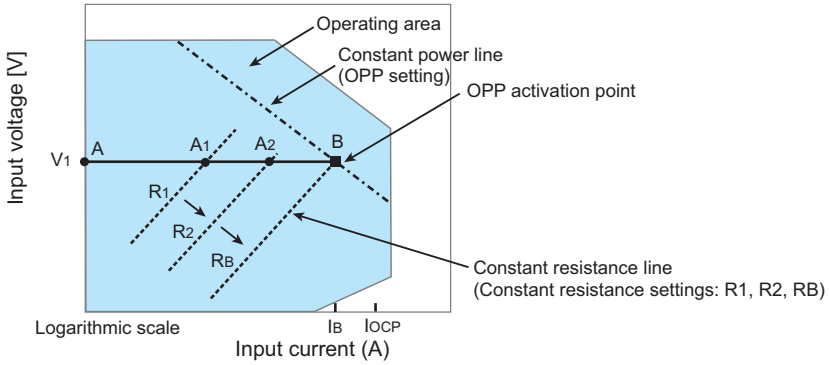
Operation in constant resistance mode

When the PLZ-5W is used in CR mode, the PLZ-5W operates as a constant resistance load as shown in the following figure. When voltage V1 of the constant-voltage power supply varies, the PLZ-5W sinks current to maintain I = V/R, with the specified resistance R fixed. The PLZ-5W operates by sinking current. This mode cannot be used with an AC circuit.



Transition of the operating point: Overpower protection (OPP) operation

Example: Examining the load characteristics of the constant-voltage power supply in CR mode.



If the overcurrent protection (OCP) setting I_{OCP} is greater than the current value I_B at point B, when the PLZ-5W resistance is decreased ($R1 \rightarrow R2 \rightarrow R_B$) and the input current (load current) is increased with the voltage of the constant-voltage power supply at V1, the operating point moves along segment AB ($A1 \rightarrow A2 \rightarrow B$). When point B is reached, OPP is activated.

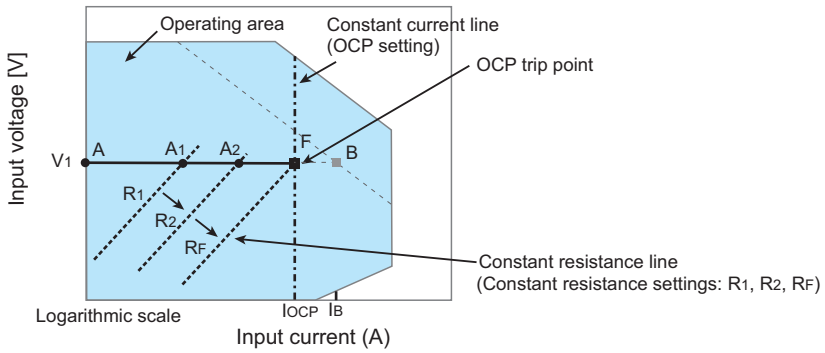
At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OPP detection.

If the action set to be executed at OPP detection is Trip, load off is executed.

If the action set to be executed at OPP detection is Limit, the PLZ-5W sinks current as a constant power load at point B. Even if you attempt to increase the input current by decreasing the resistance, the current is limited at point B. If you decrease the input current by increasing the resistance, the OPP is cleared. The PLZ-5W returns to CR mode, and the operating point moves along segment AB.

Point B	Trip	Turns off the load (stops the current flow).The PLZ-5W no longer operates as a load.
	Limit	CR mode ends. OPP continues, and the PLZ-5W sinks current as a constant power load.

Transition of the operating point: Overcurrent protection (OCP) operation



If the OCP setting I_{OCP} is smaller than the current value I_B at point B, when the PLZ-5W resistance is decreased ($R_1 \rightarrow R_2 \rightarrow R_F$) and the input current (load current) is increased with the voltage of the constant-voltage power supply at V1, the operating point moves along segment AF ($A_1 \rightarrow A_2 \rightarrow F$). When point F is reached, OCP is activated.

At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OCP detection.

If the action set to be executed at OCP detection is Trip, load off is executed.

If the action set to be executed at OCP detection is Limit, the PLZ-5W sinks current as a constant current load at point F. Even if you attempt to increase the input current by decreasing the resistance, the current is limited at point F. If you decrease the input current by increasing the resistance, the OCP is cleared. The PLZ-5W returns to CR mode, and the operating point moves along segment AF.

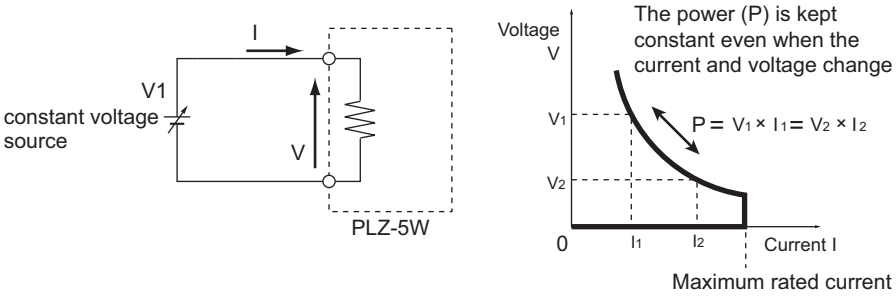
Point F	Trip	Turns off the load (stops the current flow). The PLZ-5W no longer operates as a load.
	Limit	CR mode ends. OCP continues, and the PLZ-5W sinks current as a constant current load.

Constant power (CP) mode operation

In CP mode, the PLZ-5W sinks current so that the power consumed inside the electronic load is constant.

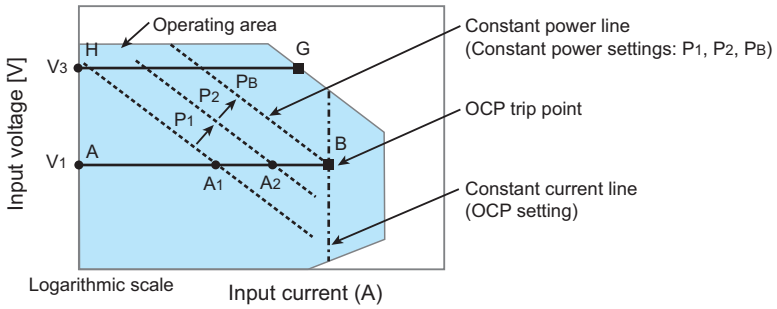
Constant power mode operation

When the PLZ-5W is used in CP mode, the PLZ-5W operates as a constant power load as shown in the following figure. When voltage V1 of the constant-voltage power supply increases, input current I decreases so that the power consumed by the PLZ-5W, P=V×I, is kept constant. In the following figure, P = V1×I1 = V2×I2.



Transition of the operating point: Overcurrent protection (OCP) operation

Example: Examining the load characteristics of the constant-voltage power supply in CP mode.



■ Operation on segment AB

If the voltage of the constant-voltage power supply is set to V1 and the power of the PLZ-5W is increased (P1→P2→PB) and the input current (load current) is increased, the operating point moves along segment AB (A1→A2→B).

When point B is reached, OCP is activated. At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OCP detection.

If the action set to be executed at OCP detection is Trip, load off is executed.

If the action set to be executed at OCP detection is Limit, the PLZ-5W sinks current as a constant current load at point B. Even if you attempt to increase the input current, the current is limited at point B. If you decrease the input current, the OCP is cleared. The PLZ-5W returns to CP mode and the operating point moves along segment AB.

Point B	Trip	Turns off the load (stops the current flow). The PLZ-5W no longer operates as a load.
	Limit	CP mode ends. OCP continues, and the PLZ-5W sinks current as a constant current load.

■ Operation on segment GH

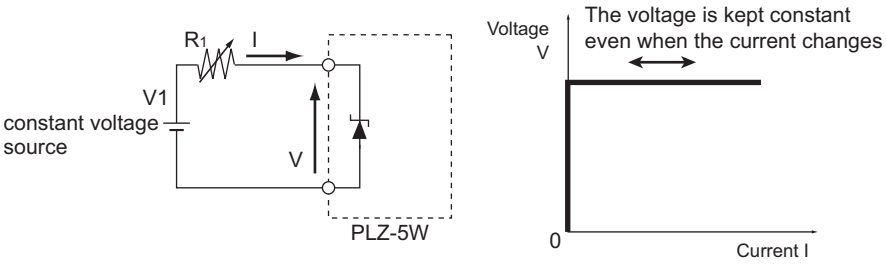
If the voltage of the constant-voltage power supply is set to V3 and the power of the PLZ-5W is increased (P1→P2→PB) and the input current (load current) is increased, the operating point moves along segment GH. Point G is the maximum power at the range being used.

Constant voltage (CV) mode operation

In CV mode, the PLZ-5W sinks current so that the voltage at the load input end of the PLZ-5W is constant.

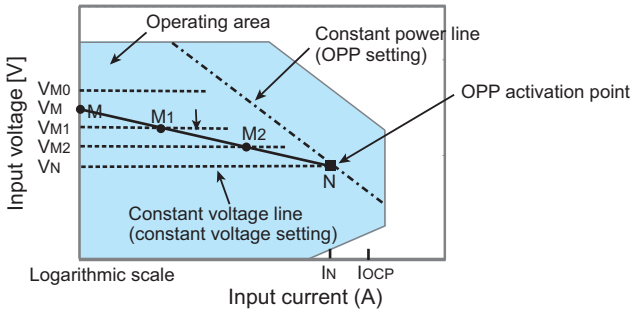
Constant voltage mode operation

When the PLZ-5W is used in CV mode, the PLZ-5W operates as a constant voltage load (shunt regulator) as shown in the following figure. When V_1 is greater than V, input voltage V is kept constant even when input current I varies. Current does not flow when V_1 is less than or equal to V. The PLZ-5W may operate unstably if R_1 is low.



Transition of the operating point: Overpower protection (OPP) operation

Example: Examining in CV mode the load characteristics of the power supply with a large internal resistance.



We assume that the overcurrent protection setting I_{OCP} is greater than current I_N at point N and denote the voltage of the constant voltage power supply as V_M. When voltage V_{M0} of the PLZ-5W is greater than V_M, no current flows. When the voltage of the PLZ-5W is decreased to a point where V_{M0} is smaller than V_M, the current starts flowing. If the voltage is decreased further ($V_{M1}\rightarrow V_{M2}\rightarrow V_N$) to increase the input current (load current), the operating point moves along segment MN ($M1\rightarrow M2\rightarrow N$).

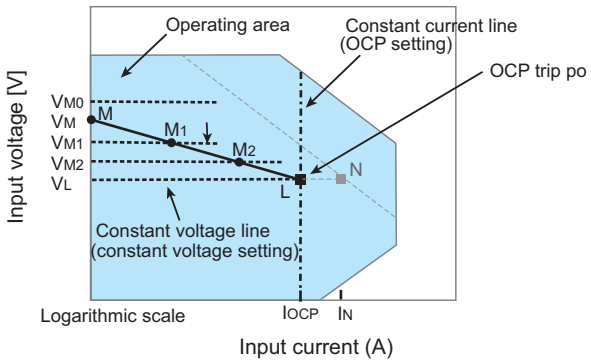
When point N is reached, OPP is activated. At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OPP detection.

If the action set to be executed at OPP detection is Trip, load off is executed.

If the action set to be executed at OPP detection is Limit, the PLZ-5W sinks current as a constant power load at point N. Even if you attempt to decrease the voltage, the current is limited at point N. If you increase the voltage, the OPP is cleared. The PLZ-5W returns to CV mode and the operating point moves along segment MN.

Point N	Trip	Turns off the load (stops the current flow). The PLZ-5W no longer operates as a load.
	Limit	CV mode ends. OPP continues, and the PLZ-5W sinks current as a constant power load.

Transition of the operating point: Overcurrent protection (OCP) operation



We assume that OCP setting I_{OCP} is smaller than current I_N at point N and denote the voltage of the constant voltage power supply as V_M. When voltage V_{M0} of the PLZ-5W is greater than V_M, no current flows. When the voltage of the PLZ-5W is decreased to a point where V_{M0} is smaller than V_M, the current starts flowing. If the voltage is decreased further ($V_{M1}\rightarrow V_{M2}\rightarrow V_L$) to increase the input current (load current), the operating point moves along segment ML ($M_1\rightarrow M_2\rightarrow L$).

When point L is reached, OCP is activated. At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OCP detection.

If the action set to be executed at OCP detection is Trip, load off is executed.

If the action set to be executed at OCP detection is Limit, the PLZ-5W sinks current as a constant current load at point L. Even if you attempt to decrease the voltage current, the current is limited at point L. If you increase the voltage, the OCP is cleared. The PLZ-5W returns to CV mode and the operating point moves along segment ML.

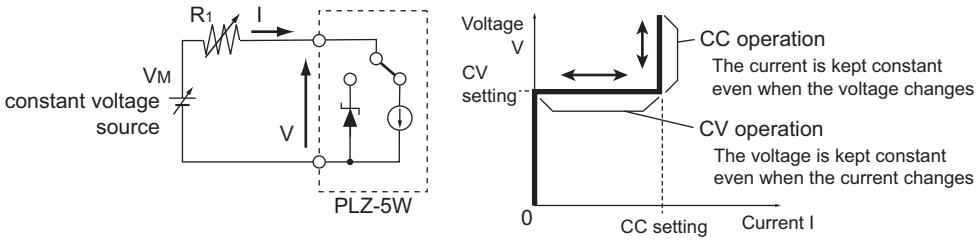
Point L	Trip	Turns off the load (stops the current flow). The PLZ-5W no longer operates as a load.
	Limit	CV mode ends. OCP continues, and the PLZ-5W sinks current as a constant current load.

Operation when CV Mode is Added to CC Mode

Constant current + constant voltage mode operation

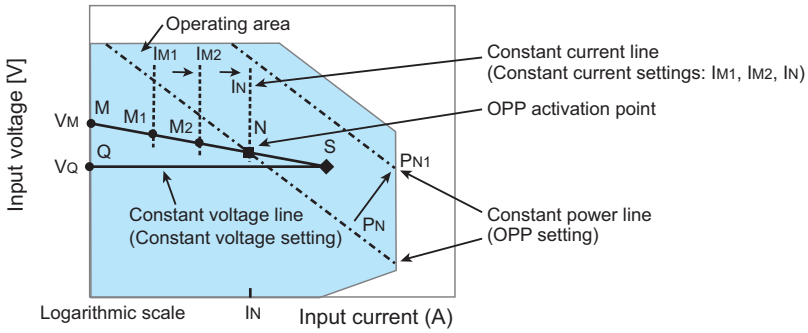
When CV mode is added to CC mode, the PLZ-5W operates as a constant current and load constant voltage load (shunt regulator), as shown in the following figure. When operating as a constant current load, the PLZ-5W continues to deliver the specified current I even when the power supply's output voltage VM changes. When operating as a constant voltage load and VM is greater than V, input voltage V is kept constant even when input current I varies. Current does not flow when VM is less than or equal to V.

Both modes are automatically switched to. In CV mode, the PLZ-5W may operate unstably if R1 is low.



Transition of the operating point: Overpower protection (OPP) operation

Example: Examining the discharge characteristics of a battery.



We denote the voltage of the battery as VM. In CC mode, if the current is increased (IM1→IM2→IN) to increase the input current (load current), the operating point moves along segment MN (M1→M2→N).

If the OPP setting is PN, the OPP is activated when point N is reached.

At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OPP detection.

If the action set to be executed at OPP detection is Trip, load off is executed.

If the action set to be executed at OPP detection is Limit, the PLZ-5W sinks current as a constant power load at point N. Even if you attempt to increase the input current, the current is limited at point N. If you decrease the current, the OPP is cleared. The PLZ-5W returns to CC mode and the operating point moves along segment MN.

Point N	Trip	Turns off the load (stops the current flow). The PLZ-5W no longer operates as a load.
	Limit	CC mode ends. OPP continues, and the PLZ-5W sinks current as a constant power load.

If the OPP setting is PN1, the OPP is not activated as the current is increased, and the operating point reaches point S.

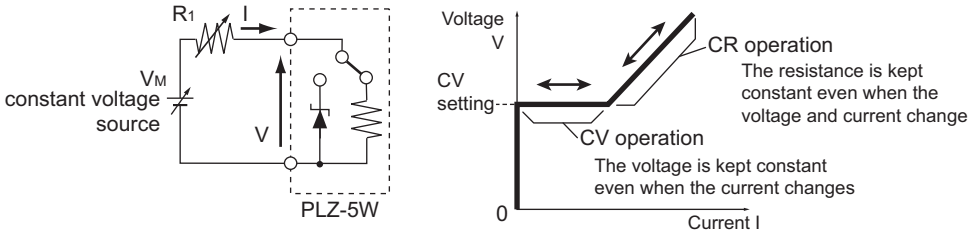
Here, the operation mode is CV. The voltage is fixed to voltage VQ set in advance. In this case, the operating point moves along segment QS. The current is determined by the battery voltage and its internal resistance.

Operation when CV Mode is Added to CR Mode

Constant resistance + constant voltage mode operation

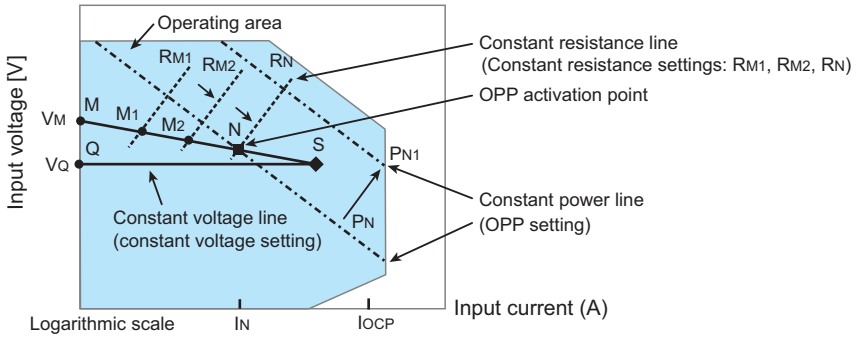
When CV mode is added to CR mode, the PLZ-5W operates as a constant resistance load and constant voltage load (shunt regulator), as shown in the following figure. When the PLZ-5W operates as a constant resistance load and voltage VM of the constant-voltage power supply is varied, the PLZ-5W sinks current to meet I=V/R according to the specified resistance R. When operating as a constant voltage load and VM is greater than V, input voltage V is kept constant even when input current I varies. Current does not flow when VM is less than or equal to V.

Both modes are automatically switched to. In CV mode, the PLZ-5W may operate unstably if R1 is low.



Transition of the operating point: Overpower protection (OPP) operation

Example: Examining the discharge characteristics of a battery.



We assume that OCP setting IOCP is greater than current IN at point N and denote the voltage of the battery as VM. In CR mode, if the resistance is decreased (RM1→RM2→RN) to increase the input current (load current), the operating point moves along segment MN (M1→M2→N). If the OPP setting is PN, the OPP is activated when point N is reached.

At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OPP detection.

If the action set to be executed at OPP detection is Trip, load off is executed.

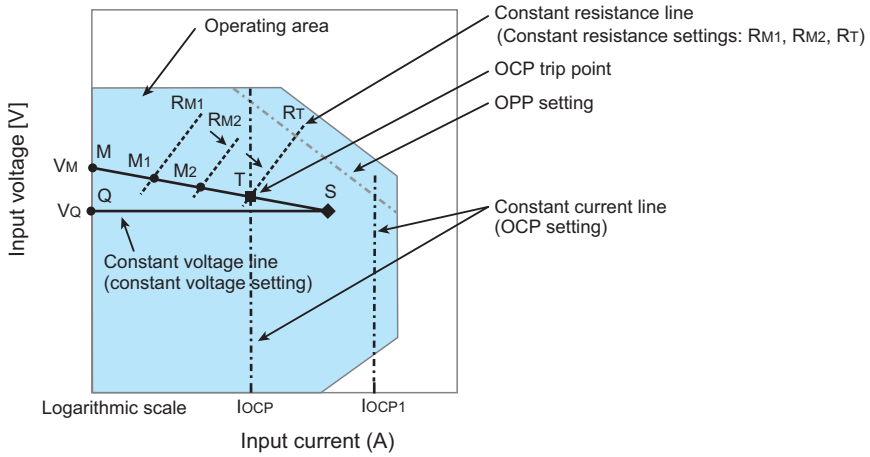
If the action set to be executed at OPP detection is Limit, the PLZ-5W sinks current as a constant power load at point N. Even if you attempt to increase the current by decreasing the resistance, the current is limited at point N. If you decrease the current by increasing the resistance, the OPP is cleared. The PLZ-5W returns to CR mode and the operating point moves along segment MN.

Point N	Trip	Turns off the load (stops the current flow). The PLZ-5W no longer operates as a load.
	Limit	CR mode ends. OPP continues, and the PLZ-5W sinks current as a constant power load.

If the OPP setting is PN1, the OPP is not activated as the current is increased by decreasing the resistance, and the operating point reaches point S.

Here, the operation mode is CV. The voltage is fixed to voltage VQ set in advance. In this case, the operating point moves along segment QS. The current is determined by the battery voltage and its internal resistance.

Transition of the operating point: Overcurrent protection (OCP) operation



We assume that OCP setting I_{OCP} is less than the current produced by tripping of the over-power protection (OPP) and denote the voltage of the battery as V_M. In CR mode, if the resistance is decreased (R_{M1}→R_{M2}→R_T) to increase the input current (load current), the operating point moves along segment MT (M1→M2→T).

If the OCP setting is I_{OCP}, the OCP is activated when point T is reached. At this point, two types of operation are available on the PLZ-5W depending on which action is set to be executed at OCP detection.

If the action set to be executed at OCP detection is Trip, load off is executed.

If the action set to be executed at OCP detection is Limit, the PLZ-5W sinks current as a constant current load at point T. Even if you attempt to increase the current by decreasing the resistance, the current is limited at point T. If you decrease the current by increasing the resistance, the OCP is cleared. The PLZ-5W returns to CR mode and the operating point moves along segment MT.

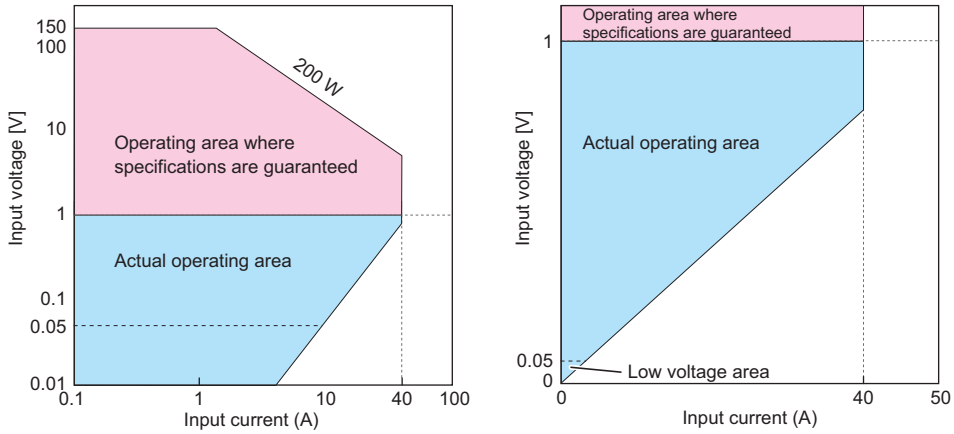
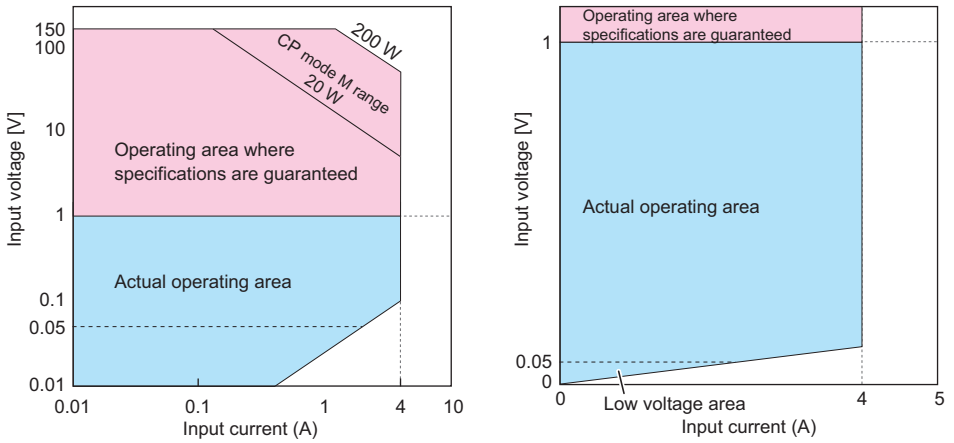
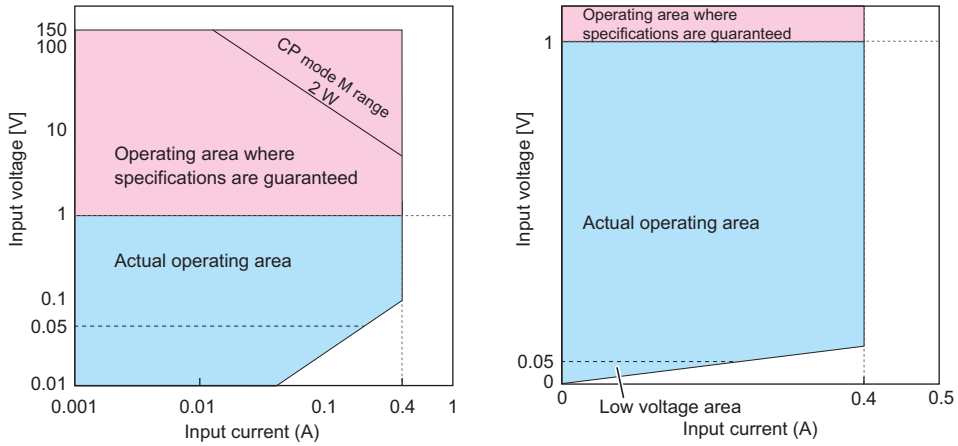
Point T	Trip	Turns off the load (stops the current flow). The PLZ-5W no longer operates as a load.
	Limit	CR mode ends. OCP continues, and the PLZ-5W sinks current as a constant current load.

If the OCP setting is I_{OCP1}, the OCP is not activated as the current is increased by decreasing the resistance, and the operating point reaches point S.

Here, the operation mode is CV. The voltage is fixed to voltage V_Q set in advance. In this case, the operating point moves along segment QS. The current is determined by the battery voltage and its internal resistance.

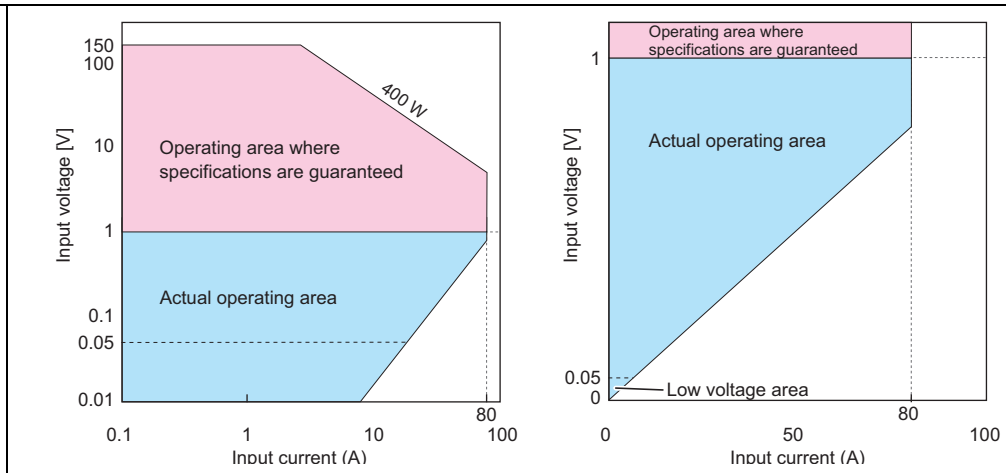
Operating Area of Each Model

Operating area of the PLZ205W

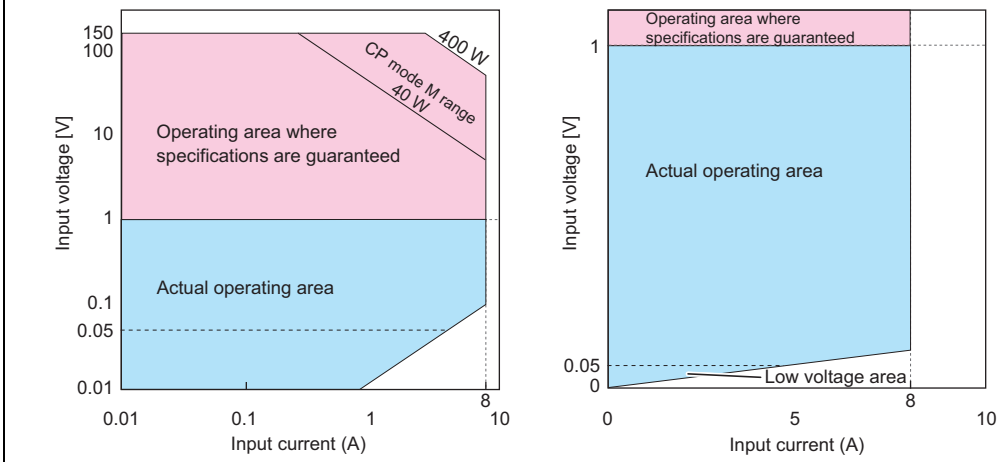
H range	
M range	
L range	

Operating area of the PLZ405W

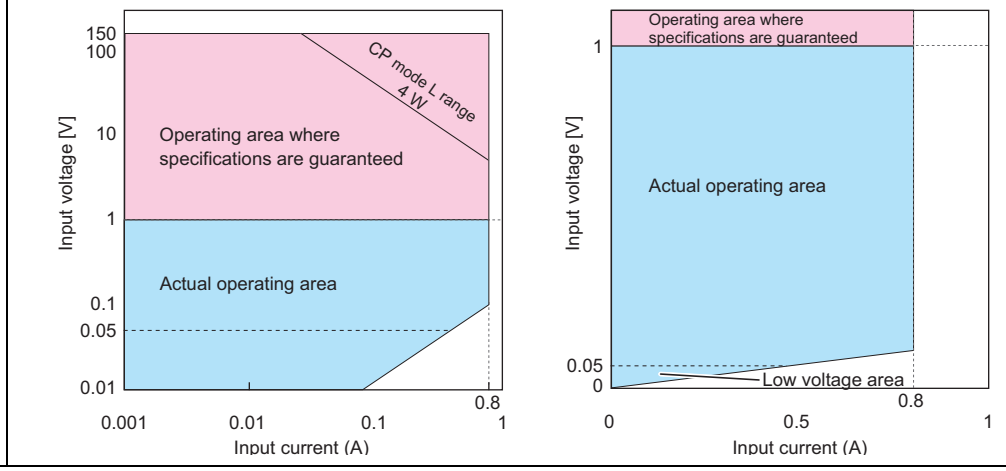
H range



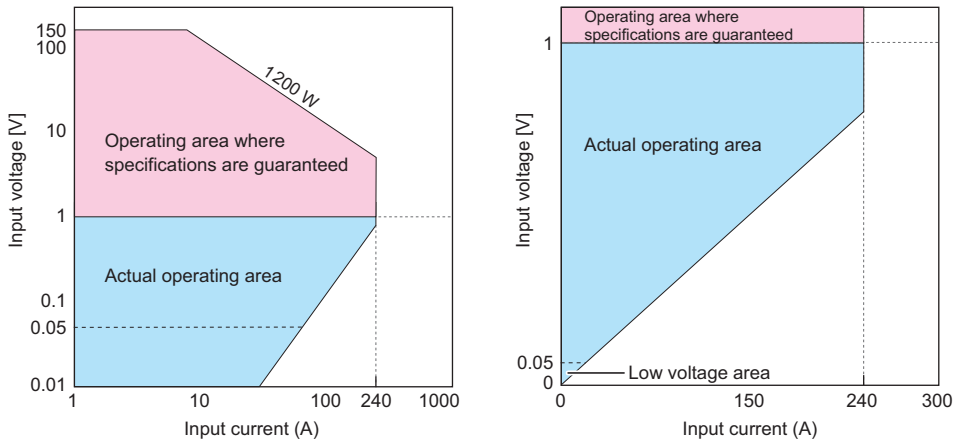
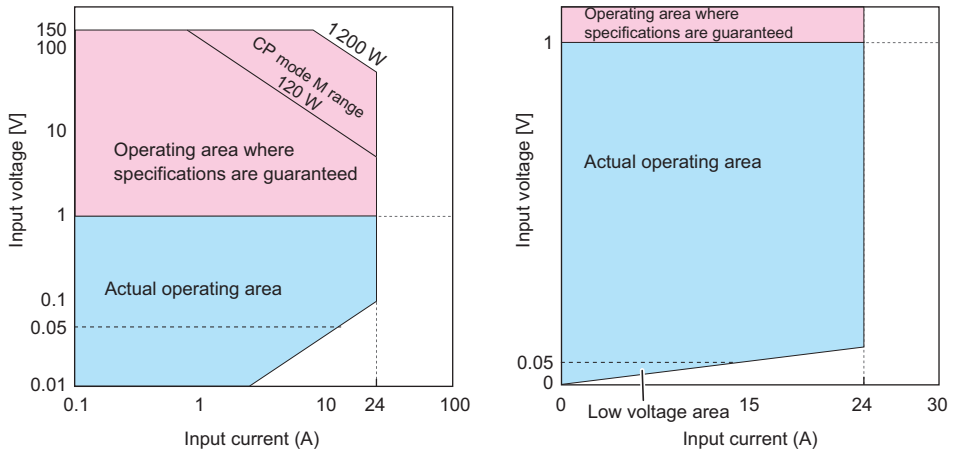
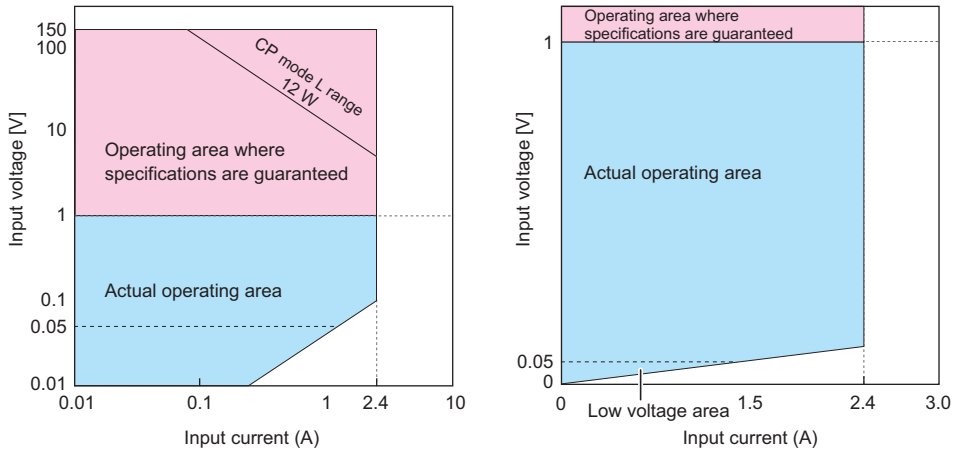
M range



L range



Operating area of the PLZ1205W

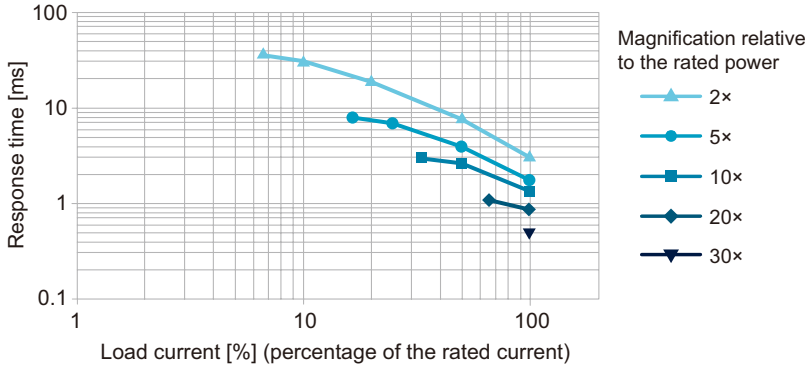
H range	
M range	
L range	

Response Time and Waveform When an OPP Is Activated

This section indicates the response time and waveform when an overpower protection (OPP) is activated when the action to perform is set to Limit.

Response time

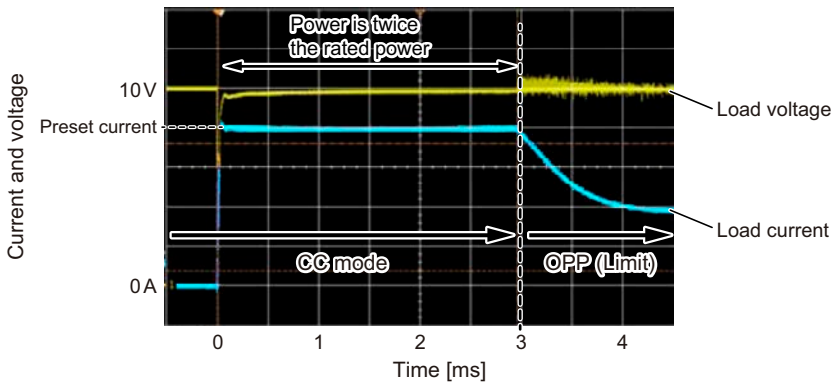
The OPP response time varies depending on the amplitude of the load power and the amplitude of the load current exceeding the OPP setting. The relationship between the time until an OPP is activated and the load power in CC mode is indicated below.



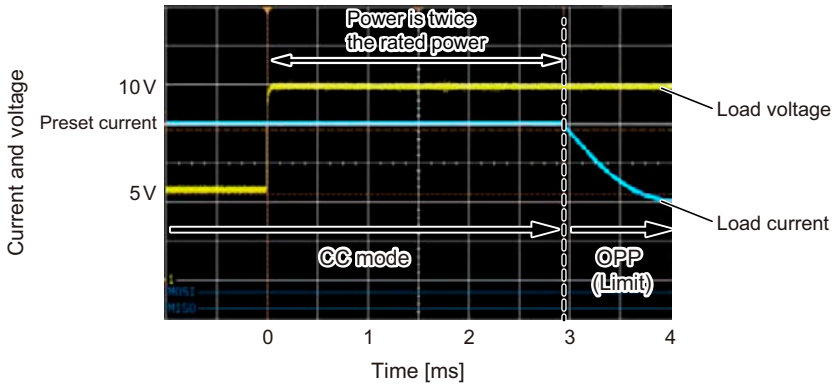
waveform

■ When the load power is twice the rated power (when set to rated current)

When the load current changes.

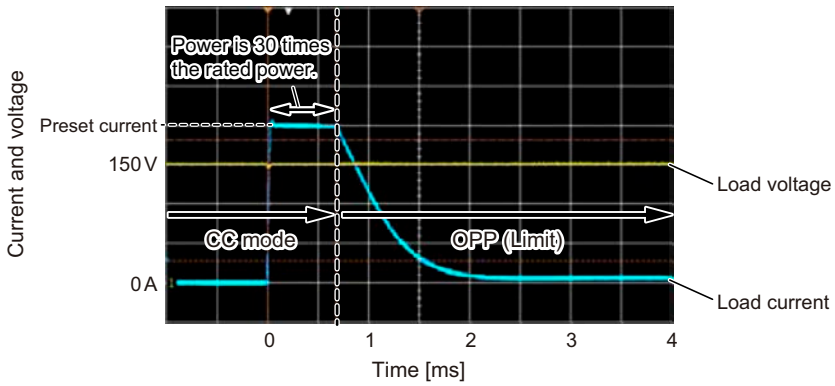


When the load voltage changes.

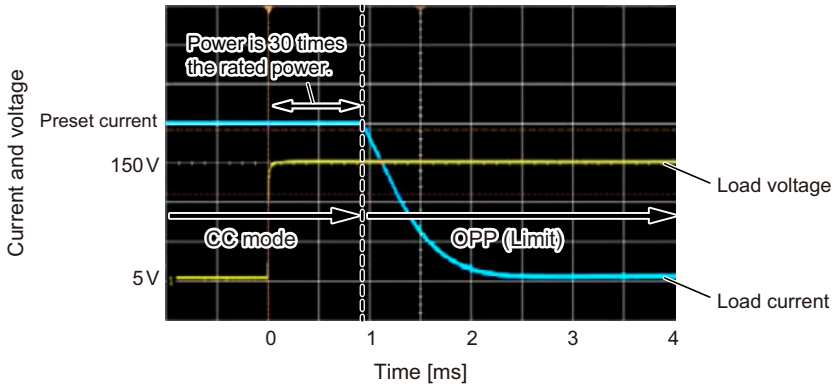


■ When the load power is 30 times the rated power (when set to rated current)

When the load current changes.



When the load voltage changes.



Main Specifications for Parallel Operation

The main specifications during parallel operation using the same model or load boosters are shown for each operation mode.

Parallel operation using the same type of electronic loads

CC mode

■ Operating range

Model name	Number of slaves	H range	M range	L range
PLZ205W	1	0 A to 80 A	0 A to 8 A	0 A to 0.8 A
	2	0 A to 120 A	0 A to 12 A	0 A to 1.2 A
	3	0 A to 160 A	0 A to 16 A	0 A to 1.6 A
	4	0 A to 200 A	0 A to 20 A	0 A to 2 A
PLZ405W	1	0 A to 160 A	0 A to 16 A	0 A to 1.6 A
	2	0 A to 240 A	0 A to 24 A	0 A to 2.4 A
	3	0 A to 320 A	0 A to 32 A	0 A to 3.2 A
	4	0 A to 400 A	0 A to 40 A	0 A to 4 A
PLZ1205W	1	0 A to 480 A	0 A to 48 A	0 A to 4.8 A
	2	0 A to 720 A	0 A to 72 A	0 A to 7.2 A
	3	0 A to 960 A	0 A to 96 A	0 A to 9.6 A
	4	0 A to 1200 A	0 A to 120 A	0 A to 12 A

■ Slew rate

Model name	Number of slaves	H range	M range	L range
PLZ205W	1	0.02 A/µs to 20 A/µs	0.002 A/µs to 2 A/µs	0.2 mA/µs to 200 mA/µs
	2	0.03 A/µs to 30 A/µs	0.003 A/µs to 3 A/µs	0.3 mA/µs to 300 mA/µs
	3	0.04 A/µs to 40 A/µs	0.004 A/µs to 4 A/µs	0.4 mA/µs to 400 mA/µs
	4	0.05 A/µs to 50 A/µs	0.005 A/µs to 5 A/µs	0.5 mA/µs to 500 mA/µs
PLZ405W	1	0.04 A/µs to 40 A/µs	0.004 A/µs to 4 A/µs	0.4 mA/µs to 400 mA/µs
	2	0.06 A/µs to 60 A/µs	0.006 A/µs to 6 A/µs	0.6 mA/µs to 600 mA/µs
	3	0.08 A/µs to 80 A/µs	0.008 A/µs to 8 A/µs	0.8 mA/µs to 800 mA/µs
	4	0.10 A/µs to 100 A/µs	0.010 A/µs to 10 A/µs	1.0 mA/µs to 1000 mA/µs
PLZ1205W	1	0.12 A/µs to 120 A/µs	0.012 A/µs to 12 A/µs	1.2 mA/µs to 1200 mA/µs
	2	0.18 A/µs to 180 A/µs	0.018 A/µs to 18 A/µs	1.8 mA/µs to 1800 mA/µs
	3	0.24 A/µs to 240 A/µs	0.024 A/µs to 24 A/µs	2.4 mA/µs to 2400 mA/µs
	4	0.30 A/µs to 300 A/µs	0.030 A/µs to 30 A/µs	3.0 mA/µs to 3000 mA/µs

CR mode

■ Operating range

Model name	Number of slaves	H range	M range	L range
PLZ205W	1	80 S to 0.004 S	8 S to 0.0004 S	0.8 S to 0.04 mS
	2	120 S to 0.006 S	12 S to 0.0006 S	1.2 S to 0.06 mS
	3	160 S to 0.008 S	16 S to 0.0008 S	1.6 S to 0.08 mS
	4	200 S to 0.01 S	20 S to 0.001 S	2 S to 0.1 mS
PLZ405W	1	160 S to 0.008 S	16 S to 0.0008 S	1.6 S to 0.08 mS
	2	240 S to 0.012 S	24 S to 0.0012 S	2.4 S to 0.12 mS
	3	320 S to 0.016 S	32 S to 0.0016 S	3.2 S to 0.16 mS
	4	400 S to 0.02 S	40 S to 0.002 S	4 S to 0.2 mS
PLZ1205W	1	480 S to 0.024 S	48 S to 0.0024 S	4.8 S to 0.24 mS
	2	720 S to 0.036 S	72 S to 0.0036 S	7.2 S to 0.36 mS
	3	960 S to 0.048 S	96 S to 0.0048 S	9.6 S to 0.48 mS
	4	1200 S to 0.06 S	120 S to 0.006 S	12 S to 0.6 mS

CV mode

■ Operating range

Model name	Number of slaves	H range	L range
PLZ205W/PLZ405W/PLZ1205W	1 to 4	1 V to 150 V	1 V to 15 V

CP mode

■ Operating range

Model name	Number of slaves	H range	M range	L range
PLZ205W	1	40 W to 400 W	4 W to 40 W	0.4 W to 4 W
	2	60 W to 600 W	6 W to 60 W	0.6 W to 6 W
	3	80 W to 800 W	8 W to 80 W	0.8 W to 8 W
	4	100 W to 1000 W	10 W to 100 W	1 W to 10 W
PLZ405W	1	80 W to 800 W	8 W to 80 W	0.8 W to 8 W
	2	120 W to 1200 W	12 W to 120 W	1.2 W to 12 W
	3	160 W to 1600 W	16 W to 160 W	1.6 W to 16 W
	4	200 W to 2000 W	20 W to 200 W	2 W to 20 W
PLZ1205W	1	240 W to 2400 W	24 W to 240 W	2.4 W to 24 W
	2	360 W to 3600 W	36 W to 360 W	3.6 W to 36 W
	3	480 W to 4800 W	48 W to 480 W	4.8 W to 48 W
	4	600 W to 6000 W	60 W to 600 W	6 W to 60 W

Parallel operation using boosters

CC mode

■ Operating range

Model name	Number of boosters	H range	M range	L range
PLZ1205W + PLZ2405WB	1	0 A to 720 A	0 A to 72 A	0 A to 7.2 A
	2	0 A to 1200 A	0 A to 120 A	0 A to 12 A
	3	0 A to 1680 A	0 A to 168 A	0 A to 16.8 A
	4	0 A to 2160 A	0 A to 216 A	0 A to 21.6 A

■ Slew rate

Model name	Number of boosters	H range	M range	L range
PLZ1205W + PLZ2405WB	1	0.18 A/µs to 180 A/µs	0.018 A/µs to 18 A/µs	1.8 mA/µs to 1800 mA/µs
	2	0.30 A/µs to 300 A/µs	0.030 A/µs to 30 A/µs	3.0 mA/µs to 3000 mA/µs
	3	0.42 A/µs to 420 A/µs	0.042 A/µs to 42 A/µs	4.2 mA/µs to 4200 mA/µs
	4	0.54 A/µs to 540 A/µs	0.054 A/µs to 54 A/µs	5.4 mA/µs to 5400 mA/µs

CR mode

■ Operating range

Model name	Number of boosters	H range	M range	L range
PLZ1205W + PLZ2405WB	1	720 S to 0.036 S	72 S to 0.0036 S	7.2 S to 0.36 mS
	2	1200 S to 0.06 S	120 S to 0.006 S	12 S to 0.6 mS
	3	1680 S to 0.084 S	168 S to 0.0084 S	16.8 S to 0.84 mS
	4	2160 S to 0.108 S	216 S to 0.0108 S	21.6 S to 1.08 mS

CV mode

■ Operating range

Model name	Number of boosters	H range	L range
PLZ1205W + PLZ2405WB	1 to 4	1 V to 150 V	1 V to 15 V

CP mode

■ Operating range

Model name	Number of boosters	H range	M range	L range
PLZ1205W + PLZ2405WB	1	360 W to 3600 W	36 W to 360 W	3.6 W to 36 W
	2	600 W to 6000 W	60 W to 600 W	6 W to 60 W
	3	840 W to 8400 W	84 W to 840 W	8.4 W to 84 W
	4	1080 W to 10800 W	108 W to 1080 W	10.8 W to 108 W

Options

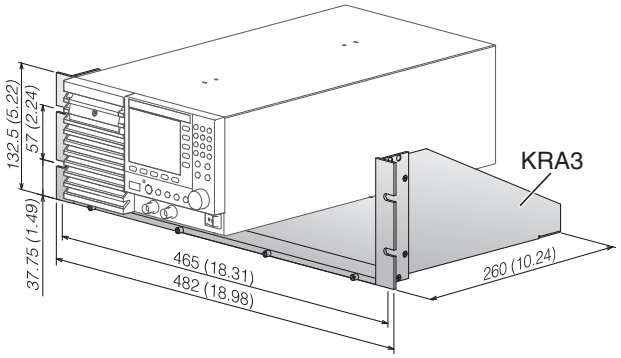
The PLZ has the following options.
For information about options, contact your Kikusui agent or distributor.

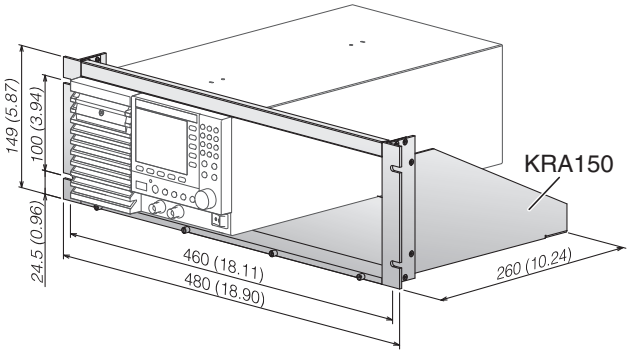
Rack adapters, brackets

These are rack mounting options. Be sure to use support angles (auxiliary brackets) to safely support the product.

Name	Model	Appropriate Model	Description
Rack adapters[1]	KRA3	PLZ205W PLZ405W	For EIA inch racks
	KRA150		For JIS millimeter racks
Bracket	KRB3-TOS	PLZ1205W	For EIA inch racks
	KRB150-TOS		For JIS millimeter racks

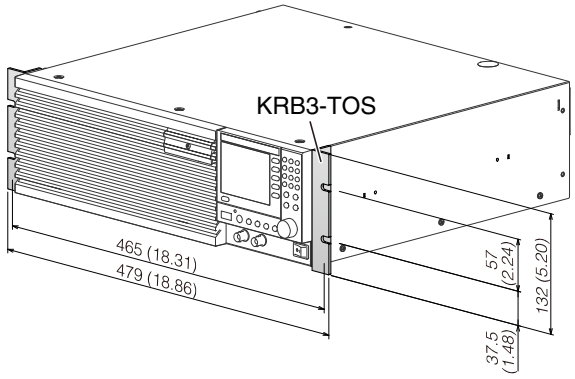
1 When using blank panels for rack adapters, please use KBP3-2.

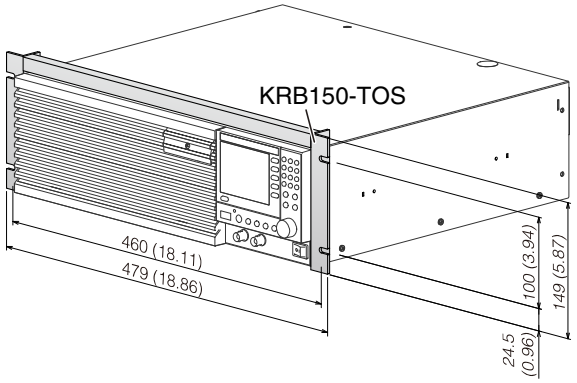




Rack adapter

Unit: mm (inches)



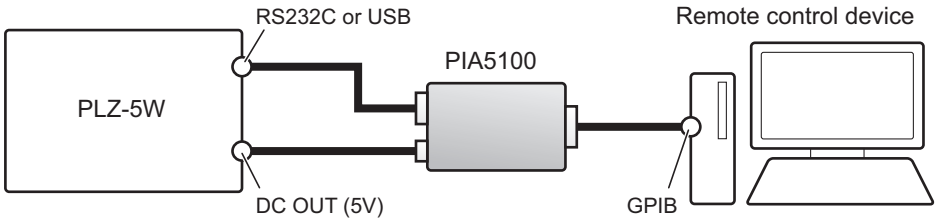


Bracket

Unit: mm (inches)

GPIB converter (PIA5100)

This converter converts RS232C or USB of the PLZ-5W to GPIB, enabling connection of a remote controller using GPIB. Perform the connection as shown below.



The GPIB communication specifications are as follows.

Item	Specifications
Hardware	Complies with IEEE Std 488.1-1987 SH1, AH1, T6, L4, SR1, PP0, DC1, DT1, C0, E1
Message terminator	LF or EOI during reception, LF + EOI during transmission
Primary address	0 to 30

When you connect a PIA5100, you cannot use the PLZ-5W's RS232C or USB port.

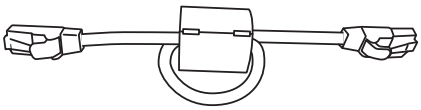
Some restrictions apply to the GPIB functions that can be used with the PIA5100. When connected through RS232C, the PLZ-5W supports the KISTD SAFU protocol.

For details, see the GPIB converter (PIA5100) operation manual.

Parallel operation signal cable kit (PC01-PLZ-5W)

This kit contains a signal cable and core for performing parallel operation or synchronous operation on the PLZ-5W.

Cable length: Approx. 30 cm



Low inductance cable

This is a load cable with suppressed inductance. It suppresses voltage drops that occur when current fluctuations are fast. For details, see the Low Inductance Cable Manual on the included CD-ROM.

Large current load cable

This load cable supports large current. It supports currents up to 1000 A.

For details, see the Large Current Load Cable Manual on the included CD-ROM.

INDEX

A

ABC preset memories *48*
Accessories *3*
Acquire *36*
Alarm
  Clear *35*
  Occurrence *35*
  Type *32*
Arbitrary I-V characteristics (ARB) mode *25*
Auto load off timer *46*

B

Battery replacement *98*
Beep sound *90*
BNC terminal *107*

C

Calibration *98*
CC+CV *23*, *121*
Cleaning *98*
CLEAR key *20*
Communication function *107*
Component names *8*
Configure *87*
Constant current (CC) mode *21*, *23*, *115*, *121*
Constant power (CP) mode *22*, *118*
Constant resistance (CR) mode *21*, *24*, *116*, *122*
Constant voltage (CV) mode *22*, *23*, *24*, *119*, *121*, *122*
CR+CV *24*, *122*
Current capacity *41*
Current monitor signal *82*
Current range *27*
Cursor keys *20*

D

Data logging *36*
Date/time setting *93*
DC INPUT terminal *15*
DC OUT 5V *133*
Default settings *95*
Device information *97*
Digital I/O *81*
DIGITAL2 *90*
Display *10*

E

Elapsed Time *41*
Enter key *20*
ESCAPE key *20*
EXT CONT connector *73*, *74*
EXT SYNC connector *53*
External control *72*

F

Factory default settings *92*, *94*, *95*
Firmware version *97*
Function keys *19*

G

GPIB converter *133*

H

Humidity range *108*

I

I MON OUT *82*
Information *97*
Inrush current *108*
Integrated data *41*
Interface settings *91*
IP address *91*, *97*
Isolation voltage *101*, *107*
I-V characteristics *25*

K

Key lock *89*
Keyboard *20*

L

Load input terminal cover
  Front *17*
  Rear *16*
Load input terminals
  Front *17*
  Rear *15*
LOAD key *20*
Load On/Load Off *20*
Load settings *10*
LOCAL key *57*
Lock *89*

M

Malfunctions and causes *99*
Manufacturing number *11*
MEASURE *9*
Measurement *36*
Memory *47*
Menu key *19*

N

Numeric keypad *20*

O

OCPL *33*
OCPT *33*
Operating area *114*
Operation mode *21*
OPPL *33*
OPPT *33*
Outline drawing *109*
Overcurrent protection (OCP) *33*
Overhaul *98*
Overpower protection (OPP) *33*, *127*

P

Panel operation *19*
Panel settings at startup *88*
PARALLEL connector *85*
Parallel operation *83*
Power capacity *41*
Power consumption *108*
Power on/off *14*
POWER switch *14*
Preset memory *48*
Program *58*
Protection *32*, *61*, *86*
Protection plate *17*, *73*

R

Rack mounting *12*
Remote control *57*
Remote sensing *44*
Reset *92*, *94*
Reset settings *95*
Response *42*
Response speed *42*
Rotary knob *20*

S

-S *45*
+S *45*
Sanitize *94*
SCPI error *93*
Screen saver *88*
Sensing cable *44*
Sensing connector *44*
Sequence *58*, *69*
Sequence creation tutorial *65*

SEQUENCE key *9*
Serial number *11*
Setup memory *50*
Short *28*
Signal output/input *90*
Slew rate *27*, *113*
Soft start *43*
SOURCE key *9*
Specifications *101*
Step *58*
Sub-function keys *19*
Switching *29*
Synchronized operation *53*
SYSTEM key *9*
System settings *87*

T

Temperature range *108*
Time measurement *41*
Time setting *93*
Time zone *93*
TRIG OUT connector *81*
Trigger input/output *81*
Trigger source *37*, *46*, *63*, *70*
Troubleshooting *99*

U

Undervoltage protection (UVP) *34*
Update *97*
USB *8*, *20*, *97*

V

Version *97*
Voltage range *27*

W

Watchdog protection (WDP) *35*
Weight *108*

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.

KIKUSUI ELECTRONICS CORP.

1-1-3 Higashiyamata, Tsuzuki-ku, Yokohama,
224-0023, Japan
Tel: +81-45-593-7570 Fax: +81-45-593-7571

Website http://www.kikusui.co.jp/en