P L Z - 4 W H   S E R I E S

NEW

Multi-functional Electronic Load
PLZ-4WH Series

Maximum operating voltage: 650V
165W, 330W, 1000W: 3 types
With connecting boosters (1000W type exclusive), maximum of 9kW/450A
Operating mode for constant current, constant resistance, constant voltage, constant power,
constant current + constant voltage, and constant resistance + constant voltage
Sequence function (up to 1024 steps)
Voltage monitor terminal for monitoring high voltage
Equipped as standard with USB 2.0, GPIB, and RS-232C

KIKUSUI

High-Voltage Electronic Load *650V*
All new design with upgraded performance !

For EV and HEV high-voltage converters. With the booster, extended capacity at a low cost can be realized!

In recent years, the market trend of various devices that compose in the automotive electronics such as EV, HEV, and the new energy market for PV power generation, fuel cells, secondary batteries have been moved to higher voltage and larger capacities. At the same time, it has increased the demand for the Electronic Load evaluation equipment to meet these new requirement. The PLZ-4WH Series continues to provide excellent operability of the conventional model (PLZ-4W Series) while extending the maximum operating voltage to 650V. Furthermore, when a booster unit (PLZ2004WHB) is connected, up to 9kW/450A can be realized with less space and at a low cost. The interface, USB, GPIB, and RS-232C functions comes as standard and supports automated testing applications.

Applications	EV and HEV high-voltage converter evaluation testing PV power generation, fuel cell, secondary batteries, and other evaluation testing High-voltage device evaluation testing

Actual size

DC INPUT
165W
5-650V
0-8.25A

I MON OUT
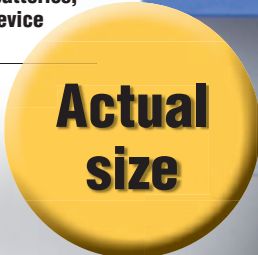
D C   E L E C T R O N I C   L O A D   **NEW**

Multi-functional Electronic Load
PLZ-4WH Series

4 model

■ Product line-up

Model	Operating voltage	Current	Power
PLZ164WH	5V ～ 650V	8.25A	165W
PLZ334WH		16.5A	330W
PLZ1004WH		50A	1000W
PLZ2004WHB		100A	2000W

[Other features]

● Parallel operation function ● Communication function ● Voltage monitor output ● Current monitor output ● Adjustable slew rate ● Switching operation ● Soft start ● Elapsed time display
● Auto load-off timer ● Remote sensing ● External load on/off control input ● External range switching input ● External trigger input ● External alarm input ● Alarm status output
● Load-on status output ● Range status output ● Short signal ● External voltage control (CC, CR, CV, and CP modes) ● External resistance control (CC, CR, CV, and CP modes)
● Overvoltage protection (OVP) ● Overcurrent protection (OCP) ● Overpower protection (OPP) ● Overheat protection (OHP) ● Undervoltage protection (UVP) ● Reverse connection protection (REV)
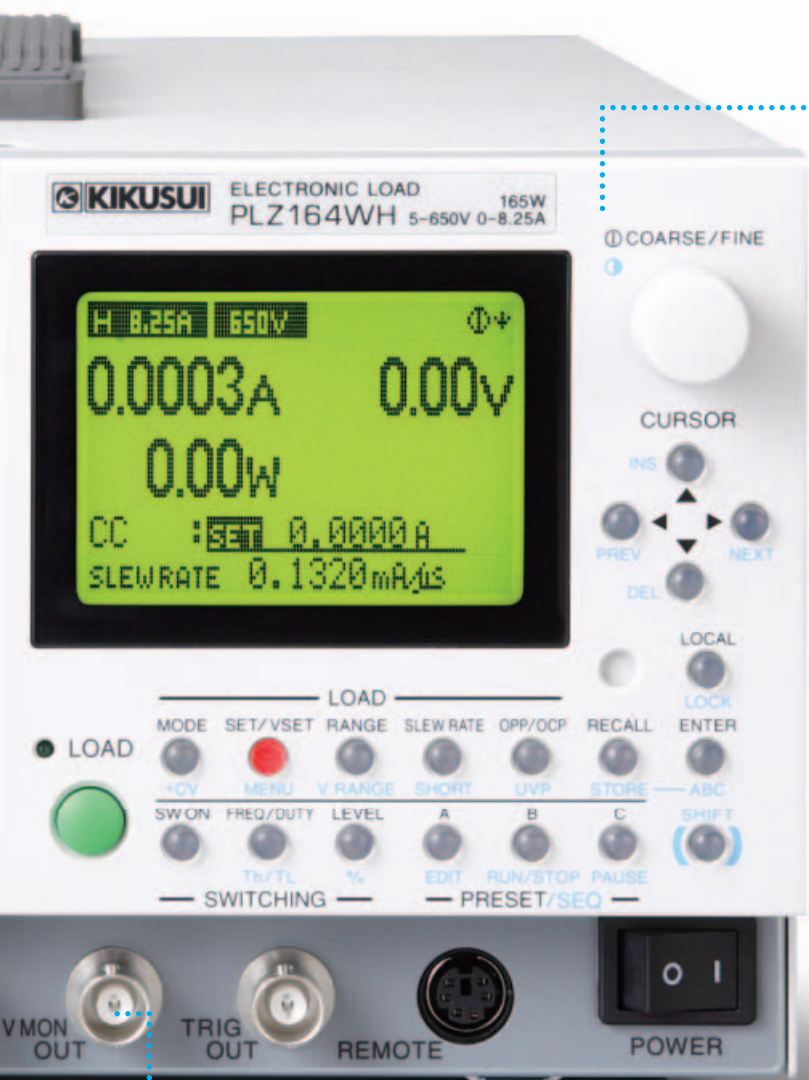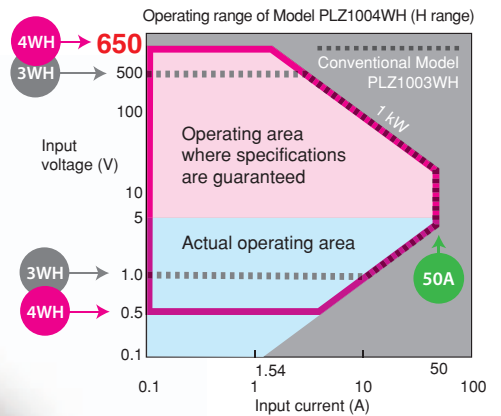
Reliable testing supported by ease of use

The front panel is the common design in all of PLZ-4W Series. Since operability is uniform, tests can be set up quickly and easily.

Operating range up to 650 V

The PLZ-4WH supports input voltages of up to 650V, and it can be used to evaluate EV and HEV in-vehicle chargers, DC/DC converters, and battery cells; evaluate power supplies for high-voltage DC electric supply systems; perform PFC tests on European and other three-phase 400V system input power supplies; and evaluate and test high-voltage parts related to such equipment. Moreover, it achieves to enlarge further operating range. (See the figure below.) It can operate from 5V, and even if the current is more than 0.5V and less than 5V, it can be used with reduced current.

● Comparison with our conventional PLZ-3WH (PLZ1003WH) model

Operating range of Model PLZ1004WH (H range)

Input voltage (V)

- Operating area where specifications are guaranteed
- Actual operating area

Conventional Model PLZ1003WH

1 kW

50A

4WH → 650
3WH → 500
100
10
5
3WH → 1.0
4WH → 0.5
0.1

Input current (A)
0.1   1   1.54   10   50   100

Easy measurement of voltage and current

In addition to an insulated-type current monitor terminal, an insulated-type voltage monitor terminal has been attached to the front panel. This makes it possible to measure voltage and current simply and with confidence.

When set in 650V range	100:1
When set in 65V range	10:1

Full-featured interface communication function

The unit comes equipped as standard with USB, GPIB, and RS-232C functions, so it can easily be incorporated into a variety of inspection systems.

Achieving up to 9kW/450A with less space and low cost

By connecting the maximum of four PLZ2004WHB boosters (sold separately) to the PLZ1004WH, it is possible to use the product as an Electronic Load unit for up to 9kW/450A. Compared to parallel operation of the same model, size (space) reductions of up to about 30%, can be achieved. Incidentally, optional PC01-PLZ-4W and PC02-PLZ-4W parallel operation cables will be required for connections depend on the number of units to be connected.

■ boosters PLZ2004WHB

*Exclusively used for Model PLZ1004WH.
It can not be used to connect any other model.

● Example combination
3 kW system consisting of PLZ1004WH (top) and PLZ2004WHB booster (bottom)

● Parallel operating units and capacity (maximum current and power)

Slave Unit	1 Unit	2 Units	3 Units	4 Units
PLZ2004WHB	150A 3000W	250A 5000W	350A 7000W	450A 9000W

● In comparison of the conventional model for the maximum 9kW system

Approx. **30%** of reduced volume
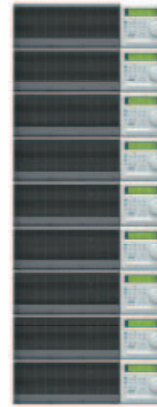
Conventional Model
PLZ-3WH Series
PLZ1003WH×9

NEW
PLZ-4WH Series
PLZ1004WH ＋ PLZ2004WHB×4

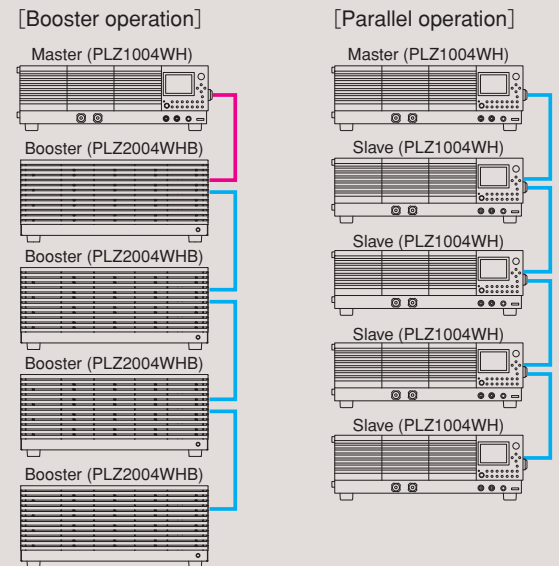## *Capable of parallel operation with up to five units of the same model*

Parallel operation without the use of boosters is also possible up to five units of the same model, including the master unit, can be connected in parallel (5kW/250A maximum). In this case, the system operates under the master-slave configuration, and the master unit controls and displays the entire system. Note that optional PC01-PLZ-4W parallel operation cables will be required for connections depend on the number of units to be connected.

● Parallel operating units and capacity (maximum current and power)

Slave Unit	1 Unit	2 Units	3 Units	4 Units
PLZ164WH	16.5A 330W	24.75A 495W	33A 660W	41.25A 825W
PLZ334WH	33A 660W	49.5A 990W	66A 1320W	82.5A 1650W
PLZ1004WH	100A 2000W	150A 3000W	200A 4000W	250A 5000W

*The constant current mode setting accuracy and current measurement accuracy can be set to the same accuracy as that of the main unit by calibrating in parallel operation.

● Basic connection diagram

[Booster operation]
Master (PLZ1004WH)
Booster (PLZ2004WHB)
Booster (PLZ2004WHB)
Booster (PLZ2004WHB)
Booster (PLZ2004WHB)

[Parallel operation]
Master (PLZ1004WH)
Slave (PLZ1004WH)
Slave (PLZ1004WH)
Slave (PLZ1004WH)
Slave (PLZ1004WH)

PC02-PLZ-4W parallel cable (for connecting main unit and booster)
PC01-PLZ-4W parallel cable

★ *Large capacity systems (9kW and above), rack systems and so on is also able to be supported. For details, please contact us.*

Low range (1/100) feature

In CC, CR, and CP modes, three ranges are available: H, M, and L. The L range is 1/100, enabling coverage from low to high power with a single unit.

● **Current setting resolution**

	PLZ164WH	PLZ334WH	PLZ1004WH
H	300µA	1mA	2mA
M	30µA	100µA	200µA
L	3µA	10µA	20µA

Ability to switch between a wide range of response speeds

The PLZ-4WH detects input current and voltage, and it operates by negative feedback control of those values. It secures and maintains stable operation by enabling the user to select the optimum speed of response by setting the negative feedback control response as shown below to counter operational instability that occurs in connection with the response characteristics of the test object, length of the load wiring, or size of the loop, for instance.

CC, CR modes (4 stages)

- 1/1: Normal response speed
- 1/2: Half the normal speed
- 1/5: One-fifth the normal speed
- 1/10: One-tenth the normal speed
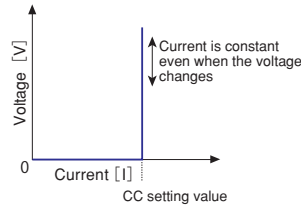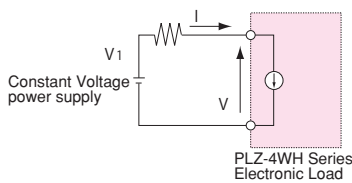
CV mode (5 stages)

- 100: 100 times the normal speed
- 10: 10 times the normal speed
- 1/1: Normal response speed
- 1/10: One-tenth the normal speed
- 1/100: One-hundredth the normal speed

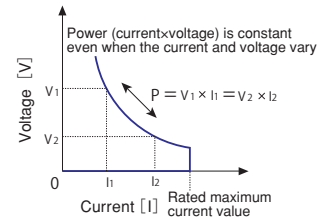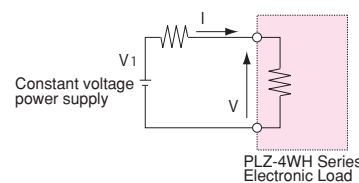## Support for six operation modes

The PLZ-4WH is equipped with six operation modes: constant current, constant resistance, constant voltage, constant power, constant current + constant voltage, and constant resistance + constant voltage modes.
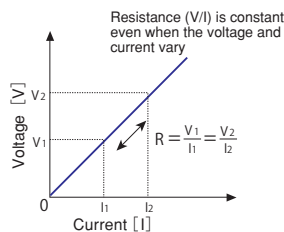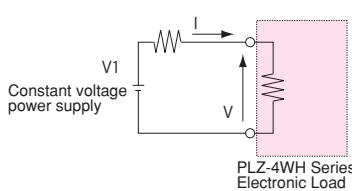
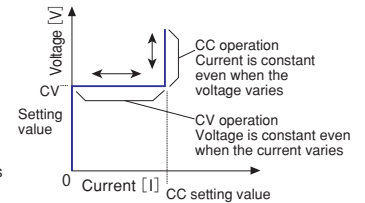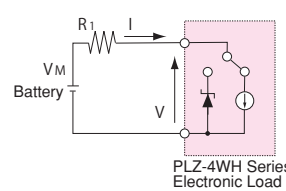| Equivalent circuits and operation in each mode |
|---|

●Constant current mode(CC)

Current is constant even when the voltage changes

CC setting value

●Constant power mode(CP)

Power (current×voltage) is constant even when the current and voltage vary

$$P = V_1 \times I_1 = V_2 \times I_2$$

Rated maximum current value

●Constant resistance mode(CR)

Resistance (V/I) is constant even when the voltage and current vary

$$R = \frac{V_1}{I_1} = \frac{V_2}{I_2}$$

●Constant current+constant voltage mode(CC+CV)

CC operation
Current is constant even when the voltage varies

CV operation
Voltage is constant even when the current varies

CC setting value

●Constant voltage mode(CV)

Voltage is constant even when the current varies

●Constant resistance+constant voltage mode(CR+CV)

CR operation
Resistance (V/I) is constant even when the voltage and current vary

CV operation
Voltage is constant even when the current varies

Load-on/off operations

▶ Adopting the Load-on/off functions that flexibly apply to the system

With load-on/off operations, the following items can be selected in addition to standard operations:

● Start-up with load-on status when the power is turned on
● Display the elapsed time of the load-on period
● Load-off after a certain time has elapsed
● Load-on/off by the relay or other external signal

Remote sensing function

▶ Compensating the voltage drop of the wiring

Connecting a sensing terminal to the DUT makes it possible to set the combined resistance, including even the resistance of the wiring, from the panel in constant resistance mode. Also, points that connect the sensing function can be set to a certain power and certain voltage in constant power mode and constant voltage mode. Furthermore, since transient characteristics are improved in these constant voltage, constant power, and constant resistance modes, it also leads to operational stability. (Voltage that can be compensated: 2V one way)

Switching function

▶ Transient response test conditions are also freely changeable on the spot
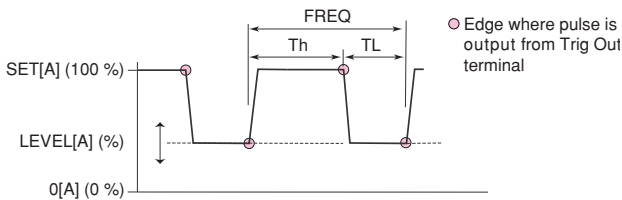
In constant current mode and constant resistance mode, switching operations of up to 4kHz are possible with the built-in oscillator. Also, the level, frequency, duty cycle (ratio), and other configuration parameters can be changed even during a load-on period.

【Configuration parameters】
■ Operation modes: CC and CR
■ Duty cycle settings: 5% to 95%, in 0.1% steps
■ Frequency setting range: 1Hz to 4kHz
■ Frequency setting resolution:
　0.1Hz at 1Hz to 10Hz
　1Hz at 10Hz to 100Hz
　10Hz at 100Hz to 1kHz
　100Hz at 1kHz to 4kHz
■ Frequency setting accuracy: ±0.5% of set
　*The minimum duration for a duty cycle is 50μs.

Soft start function

## ▶ Assures even with steep voltage application

In constant current mode, the product can prevent the generation of overcurrent* even when voltage is steeply applied from the DUT in "Load On condition and with the current having been set." For example, in a battery discharge test, it can suppress the generation of overcurrent when for some reason voltage is suddenly applied to an Electronic Load used for discharge.
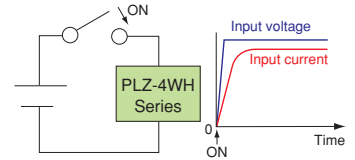
*There is electrostatic capacitance between the Electronic Load input terminals. Charging and discharging current flows to this capacitance.

▶ Ability to start up the power in CC mode

In many cases during constant voltage power supply tests, testing is conducted in constant resistance mode for start-up time measurements (during start-up), and in constant current mode during load change tests. If, however, the soft start time is set to a time corresponding to the start-up time of the constant voltage power supply, it is possible to perform start-up time measurements and load change tests in constant current mode, without changing the operation mode. (Either 1, 2, 5, 10, 20, 50, 100, or 200ms can be selected as the soft start time.)
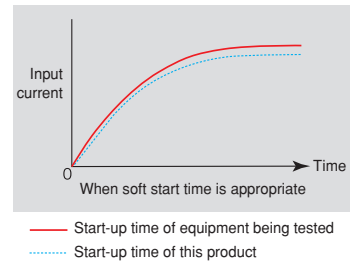
Short function

▶ Improved efficiency for the current limit evaluation with a single action

In tests such as the DC power supply "fold-back type drooping characteristics test of current limiting characteristics," the maximum current (in constant current mode) or the minimum resistance (in constant resistance mode) can be set with a single action and thus increase work efficiency. At the same time, since contact signals are output to an EXT CONT connector, it is possible to achieve even lower impedance shorting by driving exterior relays and shorting the output of the tested device.
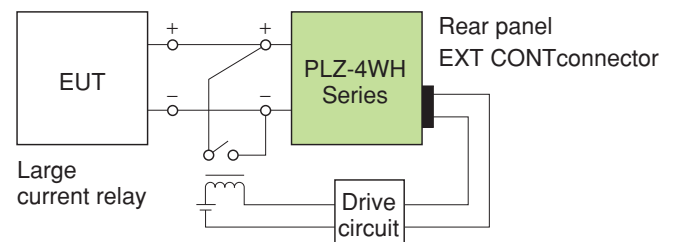
Sequence function

▶ Actual load simulation by programming current waveforms internally

Arbitrarily set sequence patterns can be saved in the built-in memory and executed. Ten normal sequence programs and one fast sequence program can be saved. Although sequence editing and execution can be performed from the panel, those tasks can also be performed easily by using the application software separately sold "Wavy"* sequence creation software.

*A personal computer will require one of the following interfaces: USB, RS232C, or GPIB.
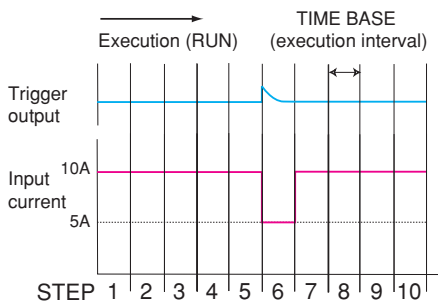
■ Normal sequence

The execution time and Load ON/OFF can be set for each step. The level can be changed not only in a stepped form but also in a ramped form. It is also possible to cancel pausing both by using the PAUSE function and by external trigger input, and to synchronize with trigger output and other external equipment.
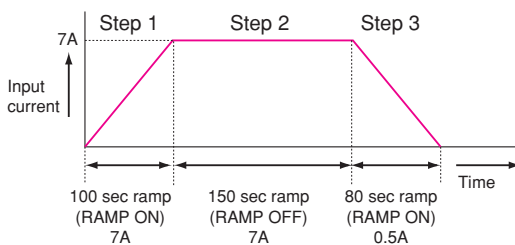
■ Fast sequence

Each step is executed at high speed. Since the time resolution is high, fast simulation is possible. The execution time, level, and trigger output can be set.

● Sequence configuration parameters

	Normal Sequence	Fast Sequence
Operation mode	CC、CR、CV、CP	CC、CR
Maximum steps	256	1024
Step execution time	1ms〜999h59min	100μs〜100ms
Time resolution (setting range)	1ms（1ms〜1min） 100ms（1min〜1h） 1s（1h〜10h） 10s（10h〜100h） 1min（100h〜999h59min）	100μs

Elapsed time display and automatic load-off timer

▶ Convenient battery discharge function

By combining four functions, namely, the elapsed time display, undervoltage protection (UVP), load-off voltage display, and automatic load-off timer, it is possible to perform two tests that are convenient for battery discharge testing, namely, the "measurement of time from discharge start to the final voltage" and "measurement from discharge start to the closed circuit voltage after a certain time has elapsed."

▲ Example of load-off voltage display
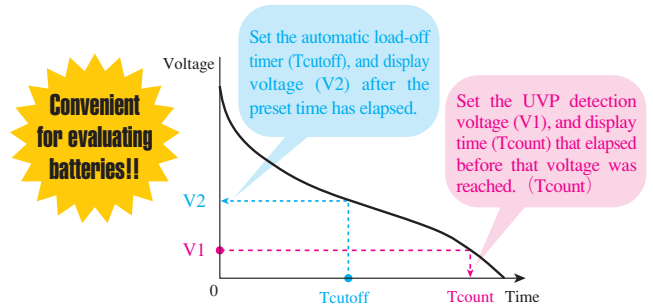
ABC preset memory

▶ Instantaneous retrieval of settings

Settings can be saved in three memories (A, B, and C) that are available for each range of each mode. Saved settings can be freely retrieved and saved even during load-on periods. In constant current + constant voltage mode and constant resistance + constant voltage mode, the memories for the constant current and constant voltage, and for the constant resistance and constant voltage, can be retrieved and saved.

Protective functions and other features

Overcurrent protection (OCP), overpower protection (OPP), overvoltage protection (OVP), undervoltage protection (UVP), overheat protection (OHP), reverse connection protection (REV), external alarm input detection, configuration setting, and setup memories (100)

Evaluation Test on EV/HEV internal chargers and DC/DC converters

● Built-in charger characteristics test and battery simulation

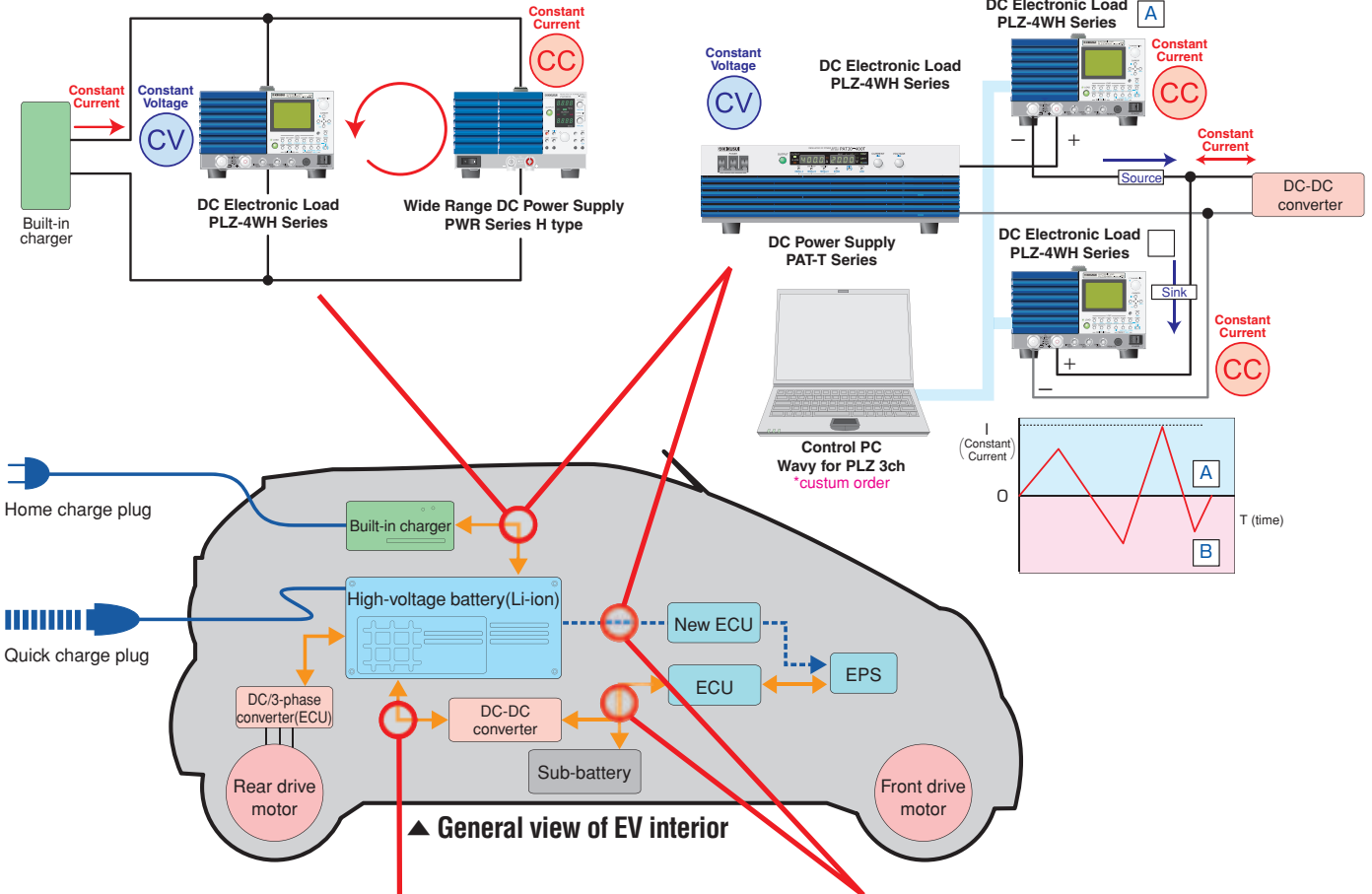By connecting a DC Electronic Load unit and high-voltage DC power supply in parallel, the PLZ-4WH is used as a simulated battery for an EV in-vehicle charger. Start-up tests and load change tests are performed in Electronic Load CV mode.

DC Electronic Load PLZ-4WH Series

Wide Range DC Power Supply PWR Series H type

Built-in charger

● Use as a high-speed constant-current power supply

The unit can be used as a high-speed constant-current power source by controlling high-speed positive current at A and negative current at B. A simulation of the regenerative current of brushless motor with regards to the interactive converter is performed.

DC Electronic Load PLZ-4WH Series A

DC Electronic Load PLZ-4WH Series

DC Power Supply PAT-T Series

DC Electronic Load PLZ-4WH Series

Source

Sink

DC-DC converter

Control PC Wavy for PLZ 3ch
*custum order

I (Constant Current) — O — T (time) — A — B

▲ General view of EV interior

Home charge plug

Quick charge plug

Built-in charger

High-voltage battery(Li-ion)

New ECU

ECU

EPS

DC/3-phase converter(ECU)

DC-DC converter

Sub-battery

Rear drive motor

Front drive motor

● For power supply variation tests

By connecting a DC Electronic Load unit and high-voltage DC power supply in parallel, the PLZ-4WH is used as a simulated battery to simulate medium speed power supply variations. Variation waveforms can be created and executed with Wavy sequence creation software.

Wide Range DC Power Supply PWR Series H typeW

DC Electronic Load PLZ-4WH Series

DC-DC converter

Control PC Wavy for PLZ

● For motor surge absorption measurement

During a brushless motor performance evaluation, the regenerative current from the brushless motor is absorbed, protecting the power supply and ECU.

I (Constant Current) — T (time)

DC Power Supply PAT-T Series

*Regenerative current from motor

ECU

M
Brushless motor

*Current flows both ways.

V (Constant Voltage) — T (time)

DC Electronic Load PLZ-4WH Series

*Absorbs regenerative current.
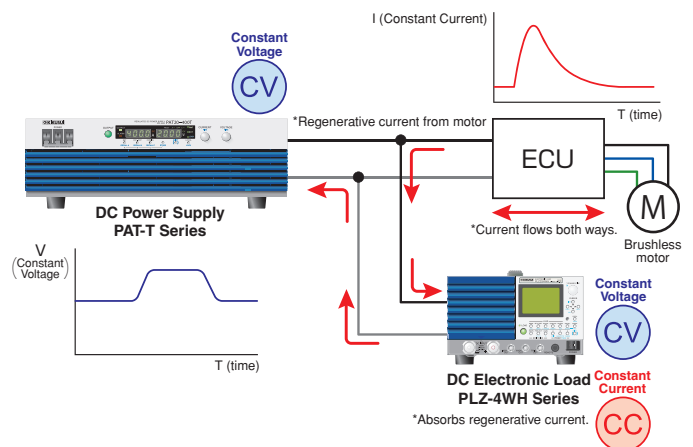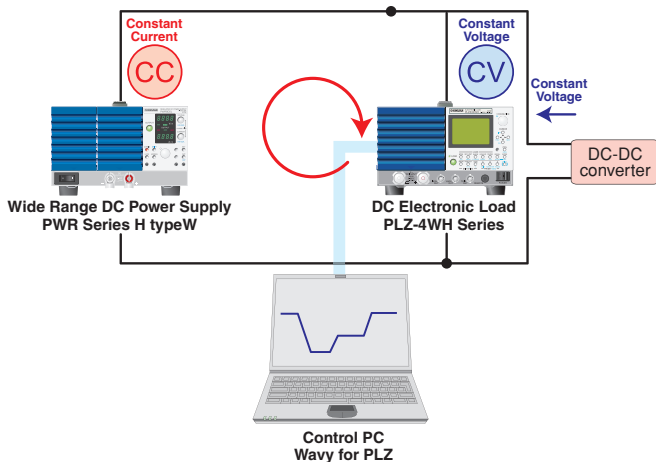
★ *Select a PLZ-4W, 4WL, or 4WA Series unit according to the purpose of use. See the series lineup at the end of this catalogue.*

For evaluation test on parts

●For life performance acceleration tests

The PLZ-4WH can be used not only for temperature rise tests, long-term durability tests, pulse interrupt characteristics tests, and other high-accuracy constant current tests but also for pulse current evaluations.
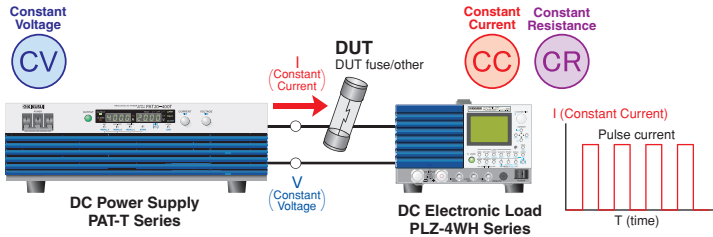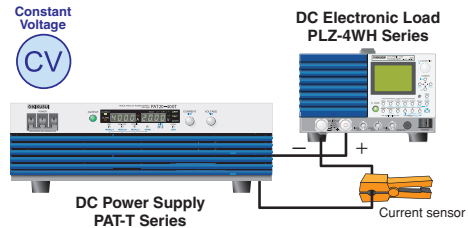
●As high-accuracy constant current power supply

By connecting a constant voltage power supply and a DC Electronic Load unit in series, the product achieves constant current at the DC Electronic Load unit's constant current accuracy.

# For evaluation test on secondary batteries

●For battery charge-discharge tests

The PLZ-4WH can be used to evaluate impedance and residual capacity by discharging electricity not only at a normal constant current but also at a pulse current corresponding to the actual load. Waveform patterns can be created with Wavy for PLZ, too.
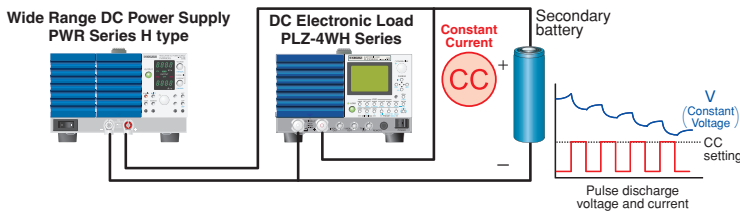
●Battery capacitor

During a secondary cell performance evaluation, it is necessary to perform a capacity test based on the battery's rating. Using the Electronic Load unit's +CV function, a capacity evaluation is performed by discharging the CV when the prescribed voltage is reached.
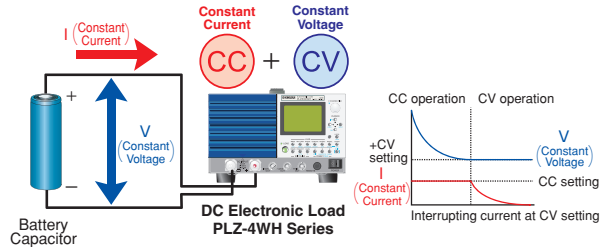
Option

"Wavy" sequence creation and control software

Wavy series

Download !

A Wavy trial version is available!

You can try it out for three weeks without functional limitations.
http://www.kikusui.co.jp/download/index_j.html

This is software that further enhances the waveform generation and sequence functions of the PLZ-4WH Series.

Using a mouse, it is possible to create and edit with the sensation of using a spreadsheet and drawing.
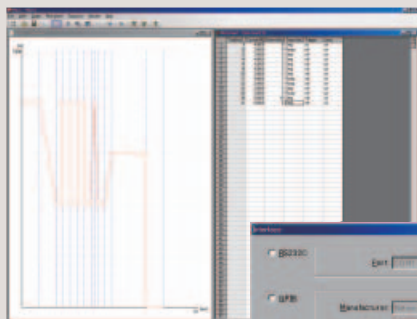
▲ Screen sample

■ Sequence creation software Wavy for PLZ-4W

Operating environment : Windows 2000 ／ Windows XP ／ Windows Vista ／ Windows 7
*See our home page for details.

● Creating and editing data of test conditions required so that the sequence operation can be done easily.
● Using the save function for data files of test conditions makes routine test condition control easy.
● The progress of executed sequences is displayed by the cursor and settings on an "execution graph."
● It is possible to observe actual output intuitively, using a "monitor graph" that plots monitored values while an execution is in progress.
● Acquired monitor data can be saved as test results.
● A "waveform image" window was newly added, making it easy to see the waveforms of alternating current (AC) signals.
● Arbitrary new waveforms can be easily created and edited. Also, arbitrary waveforms that are created can be quickly written and output.
● The product supports the selection and nonselection of sequence step items. Functions such as the pause function, trigger function, and AC waveform can be selected as needed.

PLZ164WH / PLZ334WH / PLZ1004WH specifications

Ratings

Model	PLZ164WH	PLZ334WH	PLZ1004WH
Operating voltage		5V to 650V	
Current	8.25A	16.5A	50A
Power	165W	330W	1000W
Minimum operating voltage*1		0.5V	
Load-off input resistance		2.21 [MΩ]*2	

*1 Minimum voltage when current starts to flow through the unit. Occurs at the load input terminal.
*2 When doing parallel operation with same model: 2.21/number of units [MΩ]. When doing parallel operation with PLZ2004WHB: 2.21 [MΩ].

Constant Current (CC) mode

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Operating range	H range	0 to 8.25A	0 to 16.5A	0 to 50A
	M range	0 to 825mA	0 to 1.65A	0 to 5A
	L range	0 to 82.5mA	0 to 165mA	0 to 500mA
Setting range	H range	0 to 8.6625A	0 to 17.325A	0 to 52.5A
	M range	0 to 866.25mA	0 to 1.7325A	0 to 5.25A
	L range	0 to 86.625mA	0 to 173.25mA	0 to 525mA
Resolution	H range	300 µA	1mA	2mA
	M range	30 µA	100 µA	200 µA
	L range	3 µA	10 µA	20 µA
Setting accuracy	H, M range		± (0.2 % of set + 0.1 % of f.s*1)	
	L range At least 300 µA		± (0.2 % of set + 0.1 % of f.s)	
	L range Less than 300 µA		± (0.2 % of set + 0.1 % of f.s) + Vin*2/2.21 [MΩ]	
	Parallel operation		± (1.2 % of set + 1.1 % of f.s*1)	
Input voltage variation*3	H, M range		20mA	
	L range		2mA	
Ripple	rms*4	2mA	4mA	12mA
	p-p*5	20mA	40mA	120mA
	Parallel operation (typ) rms*4		When doing parallel operation with same model: Single unit specifications x Number of units. When doing parallel operation with PLZ2004WHB: PLZ1004WH single unit specifications x (Total power capacity/kW)	
	Parallel operation (typ) p-p*5			

*1 Full scale of range, with M range being full scale of H range
*2 Vin: The voltage at the load input or sensing terminals
*3 When the input voltage is changed from 5V to 650V at a current equal to the rated power/650V
*4 Measurement frequency bandwidth: 10Hz to 1MHz
*5 Measurement frequency bandwidth: 10Hz to 20MHz

Constant Resistance (CR) mode

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Operating range*1	H range	1.65S to 30 µS (606.06mΩ to 33.333kΩ)	3.3S to 60 µS (303.03mΩ to 16.666kΩ)	10S to 200 µS (100mΩ to 5kΩ)
	M range	165mS to 3 µS (6.06Ω to 333.333kΩ)	330mS to 6 µS (3.03Ω to 166.666kΩ)	1S to 20 µS (1Ω to 49.999kΩ)
	L range	16.5mS to 0.3 µS (60.606Ω to 3.333MΩ)	33mS to 0.6 µS (30.303Ω to 1.666MΩ)	100mS to 2 µS (10Ω to 500kΩ)
Setting range	H range	1.7325S to 0 S (577.2mΩ to OPEN)	3.465S to 0 S (288.6mS to OPEN)	10.5S to 0 S (95.23mΩ to OPEN)
	M range	173.25mS to 0 S (5.772Ω to OPEN)	346.5mS to 0 S (2.886Ω to OPEN)	1.05S to 0 S (952.3mΩ to OPEN)
	L range	17.325mS to 0 S (57.72Ω to OPEN)	34.65mS to 0 S (28.86Ω to OPEN)	105mS to 0 S (9.523Ω to OPEN)
Resolution	H range	30 µS	60 µS	200 µS
	M range	3 µS	6 µS	20 µS
	L range	0.3 µS	0.6 µS	2 µS
Setting accuracy*2	H, M range		± (0.5 % of set*3 + 0.5 % of f.s*4)	
	L range		± (0.5 % of set*3 +0.5 % of f.s) + Vin*5/2.21 [MΩ]	
	Parallel operation (typ)		± (1.2 % of set +1.1 % of f.s*4)	

*1 Conductance [S] = Input current [A] / Input voltage [V] = 1 / Resistance [Ω]
*2 Converted value with input current; at sensing terminal
*3 set＝Vin/Rset
*4 When M range: Full scale of H range
*5 Vin: Rear load input terminal voltage or sensing terminal voltage

Slew rate

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Setting range*1	H range	0.132mA/µs to 0.132A/µs	0.264mA/µs to 0.264A/µs	0.8mA/µs to 0.8A/µs
	M range	13.2 µA/µs to 13.2mA/µs	26.4 µA/µs to 26.4mA/µs	80 µA/µs to 80mA/µs
	L range	1.32 µA/µs to 1.32mA/µs	2.64 µA/µs to 2.64mA/µs	8 µA/µs to 8mA/µs
Resolution (Setting range)	H range	50 µA (13.2 to 132 [mA/µs])	100 µA (26.4 to 264 [mA/µs])	300 µA (80 to 800 [mA/µs])
		5 µA (1.32 to 13.2 [mA/µs])	10 µA (2.64 to 26.4 [mA/µs])	30 µA (8 to 80 [mA/µs])
		0.5 µA (0.132 to 1.32 [mA/µs])	1 µA (0.264 to 2.64 [mA/µs])	3 µA (0.8 to 8 [mA/µs])
	M range	5 µA (1.32 to 13.2 [mA/µs])	10 µA (2.64 to 26.4 [mA/µs])	30 µA (8 to 80 [mA/µs])
		0.5 µA (0.132 to 1.32 [mA/µs])	1 µA (0.264 to 2.64 [mA/µs])	3 µA (0.8 to 8 [mA/µs])
		0.05 µA (13.2 to 132 [µA/µs])	0.1 µA (26.4 to 264 [µA/µs])	0.3 µA (80 to 800 [µA/µs])
	L range	0.5 µA (0.132 to 1.32 [mA/µs])	1 µA (0.264 to 2.64 [mA/µs])	3 µA (0.8 to 8 [mA/µs])
		0.05 µA (13.2 to 132 [µA/µs])	0.1 µA (26.4 to 264 [µA/µs])	0.3 µA (80 to 800 [µA/µs])
		0.005 µA (1.32 to 13.2 [µA/µs])	0.01 µA (2.64 to 26.4 [µA/µs])	0.03 µA (8 to 80 [µA/µs])
Setting accuracy*2			± (10 % of set + 25 µs)	

*1 In constant current mode. In constant resistance mode, the maximum slew rate in each range is 1/10.
*2 Time to reach 10% to 90% with respect to a 2% to 100% (or for M range a 20% to 100%) change from the rated current.

Constant Voltage (CV) mode

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Operating range	H range		5V to 650V	
	L range		5V to 65V	
Setting range	H range		0V to 682.5V	
	L range		0V to 68.25V	
Resolution	H range		20mV	
	L range		2mV	
Setting accuracy*1			± (0.2 % of set + 0.2 % of f.s)	
Parallel operation (typ)			± (0.2 % of set + 0.2 % of f.s)	
Input current fluctuation*2			65mV	

*1 At sensing terminal during remote sensing when input voltage is within operating range. Same with parallel operation, too.
*2 With respect to change in current at 10% to 100% of rated voltage with input voltage of 5V (during remote sensing).

Constant Power (CP) mode

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Operating range	H range	16.5W to 165W	33W to 330W	100W to 1000W
	M range	1.65W to 16.5W	3.3W to 33W	10W to 100W
	L range	0.165W to 1.65W	0.33W to 3.3W	1W to 10W
Setting range	H range	0W to 173.25W	0W to 346.5W	0W to 1050W
	M range	0W to 17.325W	0W to 34.65W	0W to 105W
	L range	0W to 1.7325W	0W to 3.465W	0W to 10.5W
Resolution	H range	10mW	20mW	100mW
	M range	1mW	2mW	10mW
	L range	0.1mW	0.2mW	1mW
Setting accuracy	H, M range		± (3 % of f.s*1)	
	L range At least 0.25W		± (3 % of f.s)	
	L range Less than 0.25W		± (3 % of f.s + Vin*2/2.21 [MΩ])	
	Parallel operation (TYP)		± (5 % of f.s*1) (at 23℃±5℃)	

*1 When M range: Full scale of H range
*2 Vin: Rear load input terminal voltage or sensing terminal voltage

Voltmeter

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Display	H range		0.00V to 650..00V	
	L range		0.000V to 65.000V	
Accuracy			± (0.1 % of rdng + 0.1 % of f.s)	
Parallel operation (TYP)				

Ammeter

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Display	H, M range	0.0000A to 8.2500A	0.000A to 16.500A	0.00A to 50.000A
	L range	0.000mA to 82.500mA	0.00mA to 165.00mA	0.00 mA to 500.00mA
Accuracy	H, M, L range		± (0.2 % of rdng + 0.3 % of f.s*1)	
	Parallel operation		± (1.2 % of rdng + 1.1 % of f.s*1)	

*1 When M range: Full scale of H range

Wattmeter

Model			PLZ164WH	PLZ334WH	PLZ1004WH
Display *1	H, M range		0.00W to 165.00W	0.00W to 330.00W	0.0W to 1000.0W
	L range	Other than CP mode	0.000W to 53.625W	0.00W to 107.25W	0.0W to 325.00W
		CP mode	0.0000W to 1.6500W	0.0000W to 3.3000W	0.000W to 10.000W

*1 Displays the product of the voltage and current display values

Switching mode

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Operating mode			CC and CR	
Duty cycle settings			5 % to 95 %*1 0.1% steps	
Frequency setting range			1Hz to 4kHz	
Frequency setting resolution	1Hz ∼ 10Hz		0.1Hz	
	10Hz ∼ 100Hz		1Hz	
	100Hz ∼ 1kHz		10Hz	
	1kHz ∼ 4kHz		100Hz	
Frequency setting accuracy			± (0.5 % of set)	

*1 The minimum time duration is 50 µs. From 1 to 4kHz, the maximum duty cycle is limited by it.

Soft start				
Model		PLZ164WH	PLZ334WH	PLZ1004WH
Operating mode		CC mode		
Time setting range*1		1,2,5,10,20,50,100,200ms	*1 Time for input current to reach 10% to 90%	
Time setting accuracy		± (30 % of set + 100 μs)		

Response			
Response speed	CC/CR mode	Switchable in 4 stages（1/1、1/2、1/5、1/10)	
	CV mode	Switchable in 5 stages（100、10、1、1/10、1/100)	

Remote sensing			
Voltage that can be compensated	One way	2V	

Protective functions		
Overvoltage protection (OVP)	110% of rated voltage for the range	
Overcurrent protection (OCP)	110% of 0.01 A rated current or 110% of the maximum current for each range: Load-off or limit selectable	
Overpower protection (OPP)	From 0.1% to 110% of rated power or 110% of the maximum power of each range: Load-off or limit selectable	
Overheat protection (OHP)	Load-off when heat sink temperature reaches 90°C	
Undervoltage detection (UVP)	Can set to Off, 5V to 650V	
Reverse connection protection (REV)	By fuse. Load-off when ALM occurs.	

Sequence functions			
Normal sequence	Operating modes	CC,CR,CV,CP	
	Maximum steps	256	
	Step execution time	1ms - 999h59min	
	Time resolution (setting range)	1ms（1ms to 1min）、100ms（1min to 1h）、1s（1h to 10h）、10s（10h to 100h）、1min（100h to 999h59min)	
Fast sequence	Operating mode	CC,CR	
	Maximum steps	1024	
	Step execution time	100 μs to 100ms	
	Time resolution	100 μs	

Other		
Elapsed time display	Measurement of time from load-on to load-off, On/Off capable 1 s to 999 h 59 min 59 s	
Auto load-off timer	Automatic load-off after elapse of preset time. Can set from 1 s to 999 h 59 min 59 s or to Off.	

Analog external control (EXT CONT connector)		
Load-on/off control input	Switchable logic level, pull-up to 5V at 10kΩ (CMOS level signal)	
External range switching input*1	2 bit, pull-up to 5V at 10kΩ (CMOS level signal)	
Trigger input	Clear the sequence operation pause when at least 10 μs are input for H (CMOS level signal for 5V system), pull-down to common by 100kΩ resister	
External alarm input	Alarm operation with L, pull-up to 5V at 10kΩ (CMOS level signal)	
Alarm status output	During alarm (OVP, OCP, OPP, OHP, REV) operation and external alarm input: On, open collector (photocoupler)*2	
Load-on status output	During load-on: On, open collector (photocoupler)*2	
Range status output	2 bit, open collector (photocoupler)*2	
Short signal	Relay contact output (30Vdc/1 A)	
External voltage control input (CC, CR, CV, CP modes)	CC, CR, CV, and CP modes. 0 to 100% of rated current, voltage, and power at 0 to 10V (CC, CV, CP). Maximum to minimum resistance at 0 to 10V (CR).	
External resistance control input (CC, CR, CV, CP modes)	0 to 100% or 100 to 0% of rated current, voltage, and power at 0 to 10kΩ (CC, CV, CP). Maximum to minimum resistance or minimum to maximum resistance at 0 to 10kΩ (CR).	
External CV voltage control input	0 to 10% of rated voltage at 0 to 10V	
Current monitor output	10V f.s. (H/L range), 1V f.s. (M range), output impedance of 1kΩ	
Voltage monitor output	10V for each range f.s., output impedance of 1kΩ	

Front BNC terminal		
Trigger output	Output of pulse during sequence operation, switching operation, or GPIB GET command input	
Current monitor output	10V for full scale (H/L range), 1V for full scale (M range)	
Voltage monitor output	6.5V for full scale in each range	

Communication functions		
GPIB	IEEE std. 488.1-1987 SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0,E1 Supports SCPI and IEEE std. 488.2-1992 specification command set.	
RS232C	D-SUB 9pin（EIA-232-D）Baud rate: 2400/4800/9600/19200 bps; Data bit: 8; Stop bit: 1/2; Parity: none; Flow control: Xon/Xoff. Supports SCPI and IEEE std. 488.2-1992 specification command set.	
USB	USB 2.0, 12 Mbps. Conforms to USBTMC-USB488 device class.	

*1 Front panel settings are only effective in the H range.   *2 Photocoupler's maximum applied voltage is 30V and maximum current is 8mA.
*3 External CV voltage control input cannot be used in CP or CV mode.

General specifications				
Model		PLZ164WH	PLZ334WH	PLZ1004WH
Input voltage range / input frequency range		100 to 240Vac (90 to 250Vac) single phase, continuous: 47-63Hz		
Power consumption		80VAmax	90VAmax	160VAmax
Inrush current*1		140Amax		
Protective conductor current (when at 100V, 50Hz: typical value)		600 μA		
Operating temperature range/humidity range		0° to 40°C, 20% to 85% rh (no condensation)		
Storage temperature range/humidity range		-20° to 70°C, 90% rh or less (no condensation)		
Ground voltage		±750Vdc		
Insulation resistance	Primary to input terminal	1000Vdc, 30MΩ or more (ambient temperature with 70% rh or less)		
	Primary to chassis	1000Vdc, 30MΩ or more (ambient temperature with 70% rh or less)		
	Input terminal to chassis	1000Vdc, 30MΩ or more (ambient temperature with 70% rh or less)		
Withstand voltage	Primary to input terminal	1500V Vac no abnormality for one minute		
	Primary to chassis	1500V Vac no abnormality for one minute		
	Input terminal to chassis	1000V Vdc no abnormality for one minute		
Dimensions (mm)		See the outline drawing.		
Weight		Approx. 7 kg (15.4 lb.)	Approx. 8kg (17.6 lb.)	Approx. 16kg (35.3 lb.)
Battery backup		Backs up configuration (setting) information		
Accessories		Power cord (2.4m length with SVT3 18AWG 3P plug) : 1pc., Load input terminal cover : 1pc., Lock plates for load input terminal cover : 2pc., Screw sets for load input terminal : 2pc., CD-R*2 : 1pc., Setup guide (Japanese/English) : 1pc., Quick reference in Japanese : 1pc., Quick reference in English : 1pc.		
Electromagnetic ompatibility*3		Compatibility with these standards: Immunity IEC61326-1:2006 Class A Emission IEC61326-1:2006 Class A IEC61000-3-2:2006+A1:2009+A1:2009 IEC61000-3-3:2008		
Safety*4		Compatibility with these standards: Low Voltage Directive 2006/95/EC EN61010-1:2001		

*1 Approximately 70A with 100Vac input   *2 CD-R contains application and sample, user's manual, communication interface manual, and VISA library (KI-VISA).
*3 Applies only to models that display CE marking on panel. Does not apply to specially ordered or modified items.
*4 This product is a Class 1 instrument. Be sure to ground this product's protective conductor terminal. If it is not properly grounded, safety cannot be guaranteed.

■ PLZ2004WHB specifications

Ratings	
Model	PLZ2004WHB
Operating voltage	5V to 650V
Current	100A
Power	2000W
Minimum operating voltage*1	0.5V
Input resistance when load-off	2.21［MΩ］*2

*1 Minimum voltage when current starts to flow to the unit. Occurs at the load input terminal.
*2 In a condition in which the master unit (PLZ1004WH) is connected.

Constant Current (CC) mode		
Operating range	H range	0 to 100A
	M range	0 to 10A
	L range	0 to 1A
Setting range	H range	0 to 105A
	M range	0 to 10.5A
	L range	0 to 1.05A
Resolution*1	H range	10mA
	M range	1mA
	L range	0.1mA
Setting accuracy*2	H,M,L range	±（1.2 % of set + 1.1 % of f.s*3）
Ripple*2	H,M,L range	PLZ1004WH unit specifications × (Total power capacity/kW) (typ)

*1 When one PLZ2004WHB unit is connected
*2 When connected to master unit
*3 Full scale of range, with M range being full scale of H range

Constant resistance (CR), constant voltage (CV), and constant power (CP) mode setting accuracy		
CR mode	H,M,L range	±（1.2 % of set + 1.1 % of f.s*1）(TYP)
CV mode	H,L range	±（0.2 % of set + 0.2 % of f.s）(TYP)
CP mode	H,M,L range	±（5 % of f.s*1）23℃±5℃ (TYP)

Measurement functions		
Voltmeter	Accuracy	H,L range	±（0.1 % of rdng + 0.1 % of f.s）(TYP)
Ammeter		H,M,L range	±（1.2 % of rdng + 1.1 % of f.s*1）(TYP)
Wattmeter		Displays the product of the values indicated by the voltmeter and ammeter

*1 M range: full scale of H range

Protective functions *1	
Overheat protection (OHP)	Load-off when heat sink temperature reaches 90°C Load-off at time of detection
Reverse connection protection (REV)	Protection by fuse

*1 Other protective functions detect and operate with the PLZ1004WH.
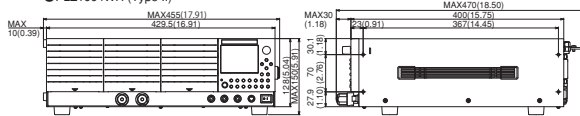
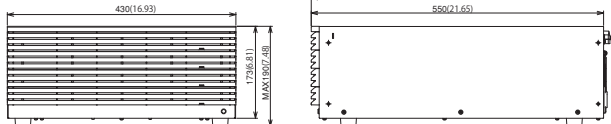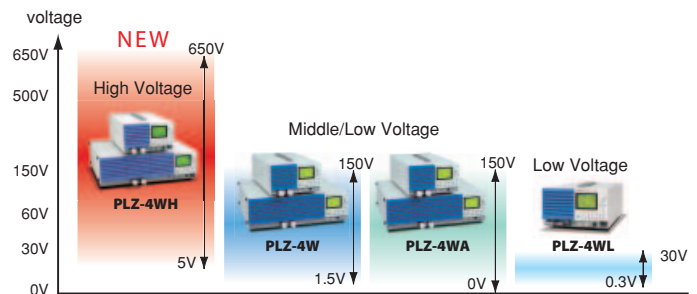| General specifications	
Model	PLZ2004WHB
Input voltage range	100Vac to 240Vac（90Vac to 250Vac）single phase, continuous
Input frequency range	47Hz to 63Hz
Power consumption	200VAmax
Inrush current*1	120Amax
Protective conductor current	600μA (typical: 100V, 50Hz)
Operating temperature range	0℃ to 40℃
Operating humidity range	20% to 85% rh (no condensation)
Storage temperature range	-20℃ to 70℃
Storage humidity range	90% rh or less (no condensation)
Ground voltage	±750Vdc
Insulation resistance	Primary to input terminal	1000Vdc, 30 MΩ or more (ambient temperature with 70% rh or less)
	Primary to chassis	1000Vdc, 30 MΩ or more (ambient temperature with 70% rh or less)
	Input terminal to chassis	1000Vdc, 30 MΩ or more (ambient temperature with 70% rh or less)
Withstand voltage	Primary to input terminal	1500V Vac, no abnormality for one minute
	Primary to chassis	1500V Vac, no abnormality for one minute
	Input terminal to chassis	1000V Vdc, no abnormality for one minute
Dimensions (mm) / weight	See the outline drawing.／Approx. 24kg (52.91 lb.)
Accessories	One power cord (2.4m length with SVT3 18AWG 3P plug), one load input terminal cover, two lock plates for load input terminal cover, two screw sets for load input terminal, and one instruction manual
Electromagnetic compatibility*2	Compatibility with these standards: Immunity IEC61326-1:2006 Class A Emission IEC61326-1:2006 Class A IEC61000-3-2:2006+A1:2009+A1:2009 IEC61000-3-3:2008
Safety*3	Compatibility with these standards: Low Voltage Directive 2006/95/EC EN61010-1:2001

*1 Approximately 60A with 100Vac input
*2 Applies only to models that display CE marking on panel. Does not apply to specially ordered or modified items.
*3 This product is a Class 1 instrument. Be sure to ground this product's protective conductor terminal. If it is not properly grounded, safety cannot be guaranteed.

■ Dimensions unit:mm(inches)

●PLZ164WH, PLZ334WH (Type I)
●PLZ1004WH (Type II)
●PLZ2004WHB

■ Series Selection

●Distributor/Representative