KIKUSUI

English Edition

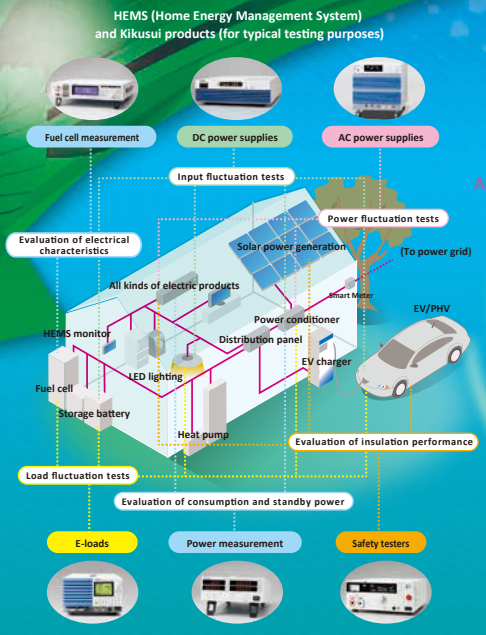
Electronic Test &
Measurement Instruments, Power Supplies

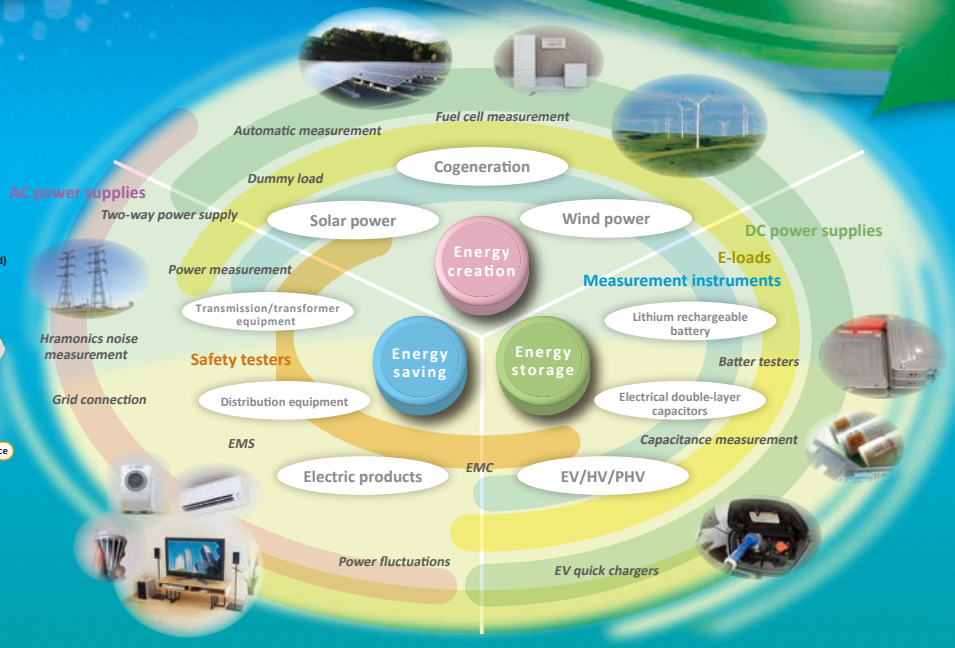
KIKUSUI PRODUCTS CATALOGUE 2020/2021

www.kikusui.co.jp

Kikusui Provides Solutions for Energy and The Infrastructure of Society.

Kikusui has identified three areas of solutions for Smart Cities – technologies in the environmental and energy saving fields. These are energy creation (power generation technologies), energy storage (power storage technologies), and energy saving (technologies for greater efficiency), and we are providing products for each of these purposes. Our primary products include DC power supplies, as well as electronic loads that absorb and consume electrical energy. In particular, our electronic loads are used as evaluation instruments that are essential for energy creation and energy storage, and large growth in sales of these products is expected. In the energy saving field, we provide AC power supplies that are key equipment for standard evaluations and grid connection (two-way connections for power supply and receiving) tests, as well as withstanding voltage testers for testing the safety of electrical and electronic devices and EMC testers for testing electromagnetic safety.





KIKUSUI WEB

INTERNET

www.kikusui.co.jp

Check our Web for the latest information!

We at the Kikusui Electronics Corporation would like to offer you information through our web site including about company profile of Kikusui, full line of Kikusui products, overseas distributors, services, new technologies, and an introduction of latest products. We also uploaded for your convenience some popular instrument drivers, which can be used with Lab VIEW or Visual Basic as download service. Electronic catalogues in PDF format are also available for each product on our web site, including detailed specifications.

Company Profile

Headquarters

Kikusui Innovation Creation Center

Fuji-Katsuyama Factory

Corporate name	Kikusui Electronics Corp.
Founded and Incorporated	August 8, 1951
Capital	2,201 million yen
President & C.E.O	K. Kobayashi
Main activities	Manufacture, sale, and export & import of electronic test and measuring instruments, power supplies and software.
Headquarters	Southwood 4F, 6-1 Chigasaki-chuo, Tsuzuki-ku, Yokohama, Kanagawa, 224-0032, Japan
Affiliate companies	FujiTEK Corp. (Japan) Kikusui Trading (Shanghai) Co., Ltd. (China) Kikusui America, Inc. (U.S.A)
Main customers	Self-Defense Force Agency / Ministry of Education, Culture, Sports, Science and Technology / Japan Atomic Energy Research Institute / Nippon Telegraph and Telephone Corp. / Hitachi, Ltd. / Toshiba Corp. / Mitsubishi Electric Corp. / NEC Corp. / Fujitsu Ltd. / Panasonic Corp. / Sony Corp. / Pioneer Electric Corp. / Kyo-cera Corp. / ALPS Electric Co., Ltd. / Murata Manufacturing Co., Ltd. / Toyota Co., Ltd. / Denso Corp. / Nissan Motor Car Co., Ltd. / Honda Motor Co., Ltd.
Main products	Power Supplies, Electronic Loads, Telecommunication Measuring Instruments, Withstanding Voltage Testers, Insulation Testers, Earth Continuity Tester, Calibrators, Signal Generators

History

1950s

1960s

1970s

1951	Kikusui Denpa established.
1962	Corporate name changed to Kikusui Electronics Corporation
1983	Fuji Katsuyama Factory established.
1986	Fujitec Co., Ltd. established as an affiliated factory of the Fuji Katsuyama Factory.
1988	Concluded exclusive agent contract with Marconi Instruments Ltd. (presently Aeroflex Incorporated), U.K. COM3000 Series Oscilloscope becomes the first category winner of the Good Design Award by MITI (Ministry of International Trade and Industry)
1991	Capital increased to 2,201,250,000 yen. Stock listed on domestic stock exchanges (November 22)
1993	Head office moved to Yokohama.
1994	Construction of Engineering Centre completed.
1995	ISO9001 certified by JQA.
1997	Construction of Head office.
2000	ISO14001 certified by JQA.
2004	Kikusui Electronics (Suzhou) Co.,Ltd. established in China. Kikusui America, Inc. established in the United States.
2006	Kikusui Trading (Shanghai) Co.,Ltd. established in China.

1980s

1990s

2000s

NEW PRODUCTS

NEW

P12

2000W model

PWR-01 Series

Compact Wide-Range DC Power Supply

The PWR-01 is a series of high performance, multifunctional, compact, wide-range DC power supplies. It consists of 16 models in total with 4 maximum voltage outputs (L, ML, MH, and H) and 4 maximum power outputs (400 W, 800 W, 1200W and 2000 W). With the PWR-01 series you can set sequences with an embedded CPU as well as analog control. The series is equipped with LAN (LXI), USB, and RS232C as standard interfaces that are essential for system integration.

P44

PCR-WE/WE2 Series

Ultra-Compact AC/DC Power Supply

The PCR-WE/WE2 is a series of multifunctional switching AC power supplies that combines accurate, high power output with an ultra-compact design. The 15 model line-up ranges from 1 kVA to 36 kVA AC/DC with single & 3 phase variable output from 6 kVA and up. The PCR-WE/WE2 also features a regenerative mode that can drastically reduce power consumption and cut the costs of operation. The PCR-WE/WE2 also supports mix-and-match parallel operation up to 144 kVA for large scale test systems. Output frequency up to 5 kHz is also available with all models for critical AC applications in the avionic industries.

P61

PLZ-5WH2 Series

Compact High-Voltage DC Electronic Load

The PLZ-5WH2 high-power DC electronic load series is where durable, reliable ingenuity meets multifunctional, high-power design. Providing 5 variety of power range line-ups, from a 1 kW bench-top style model, to a high-power model that can sink up to 20 kW of power in a single unit. You can easily select the applicable power range according to the load. Load simulation can be achieved faster than ever before thanks to the reliable, high-speed design of the PLZ-5WH2 current control circuits.

CONTENTS

NOTE:

* All products contained in this catalogue are equipment and devices that are premised on use under the supervision of qualified personnel, and are not designed or produced for home-use or use by general consumers.
* Specifications, design and so forth are subject to change without prior notice to improve the quality.
* Product names and prices are subject to change and production may be discontinued when necessary.
* Product names, company names and brand names contained in this catalogue represent the respective registered trade name or trade mark.
* Colors, textures and so forth of photographs shown in this catalogue may differ from actual products due to a limited fidelity in printing.
* Although every effort has been made to provide the information as accurate as possible for this catalogue, certain details have unavoidably been omitted due to limitations in space.
* If you find any misprints or errors in this catalogue, it would be appreciated if you would inform us.
* Please contact us to confirm specifications, price, accessories or anything that may be unclear when placing an order or concluding a purchasing agreement.

NOTE: Markings

NEW — Identifies new products appearing in this years catalog.

LAN USB GPIB RS232C RS485

Products equipped with these interfaces as standard.

LAN OPTION USB OPTION GPIB OPTION RS232C OPTION RS485 OPTION

Products optionally available with these interfaces.

DRIVERS — Products supporting instrument drivers for VisualBasic, LabVIEW, LabWindows/CVI and IVI-COM.
Refer to the down load service for drivers at Kikusui Web site.

CE — CE marked products

LXI — LXI (LAN eXtention for Instrumentation)
LXI is a type of interface standard extended to an instrumentation platform based on industry standard Ethernet (LAN) technology.
The LXI Consortium is an industry consortium with over 50 of the top T&M companies such as Agilent Technology, VXI Technology sponsoring and developing this technology. (We, Kikusui Electronics Corp, are also a member of this consorthium)

CE MARKING PRODUCT LIST

APPLICABLE MODELS FOR CE MARKING

DC Power Supply

Series	Model	Reference page	
PWR-01 Series	All models	12	*1
PWR Series	All models	15	*1
PAV Series	All models	17	*1
PWX Series	PWX750LF	19	*1
	PWX750MLF	19	*1
	PWX750MHF	19	*1
	PWX750HF	19	*1
	PWX1500L	19	*1
	PWX1500ML	19	*1
	PWX1500MH	19	*1
	PWX1500H	19	*1
PMX-A Series	All models	26	*1
PMX-Multi Series	All models	28	*2
PBZ Series	All models	33	*1
PBZ20-20A		35	*1
PBZ SR Series	All models	36	*1

Power Supply Controller

Series	Model	Reference page	
PIA Series	PIA4830	39	*1
	PIA4850	41	*1

AC Power Supply

Series	Model	Reference page	
PCR-WE/WE2 Series	All models	44	*1
PCR-MA Series	All models	47	*1
PCR-LE Series	All models	49	*1
PCR-LE2 Series	PCR6000LE2	51	*1
	PCR9000LE2	51	*1

Electronic Load

Series	Model	Reference page	
PLZ-5W Series	All models	55	*1
PLZ-5WH Series	All models	59	*1
PLZ-5WH2 Series	All models	61	*1
PLZ-4WL Series	PLZ334WL	65	*1
PLZ-4WH Series	All models	67	*1
PLZ-U Series	All models	70	*1

Battery Test System

Series	Model	Reference page	
PFX2500 Series	All models	75	*1

Safety Tester

Series	Model	Reference page	
TOS Series	TOS9300	94	*1
	TOS9301	94	*1
	TOS9301PD	94	*1
	TOS9302	95	*1
	TOS9303	95	*1
	TOS9303LC	96	*1
	TOS9320	96	*1
	TOS5300	98	*1
	TOS5301	98	*1
	TOS5302	98	*1
	TOS5200	100	*1
	TOS6210	101	*1
	TOS6200A	101	*1

Measuring Instrument

Series	Model	Reference page	
BIM1000 Series	BIM1030	106	*1
	BIM1100	106	*1

Option

Model	Reference page
OP01-PFX	75
OP02-PFX	75
OP03-PFX	75
SL01-PFX	75

ORDERING INFORMATION

*1.CE Marked model is available at all standard Input voltage as specified in each specification.
*2.CE Marked model is available only for the unit equipped with Input voltage of 234 V.
* Please indicate 'CE Marked Products' when ordering or request for the quote.

DC POWER SUPPLY SELECTION GUIDE

Wide range power supply with variable voltage and current !

With a single PWR series power supply alone, you can cover an extensive output range equivalent to what is provided by several conventional single range DC power supplies.
For example, the model that has an output power rating of 2000 W (PWR2001L) provides a seamless operation range from 40 V – 50 A to 10 V – 200 A.

Compact Wide Range DC Power Supply
PWR-01
LAN USB option GPIB RS232C
★Power factor correction circuit

Variable-switching Multi Range DC Power Supply
PWR
option USB option GPIB option RS232C
* While Supplies Last ★Power factor correction circuit

Compact Variable-switching Regulated DC Power Supply
PAV
option LAN USB RS232C RS485
200/400/600/800W
★Power factor correction circuit
P.17 to 18

1U Multi Range Programmable DC Power Supply
PWX
LAN USB option GPIB RS232C
★Power factor correction circuit

New standard of rack mount power supply.
Variable voltage and current combinations with 3 times of coverage ratio of its range within the rated power.

Equipped with the digital I/F as standard! new standard for the compact DC power supply.

Compact DC Power Supply
PMX-A

LAN USB option GPIB RS232C
35 to 105W
P.26 to 27
18V • 35V • 70V •
110V • 250V • 350V • 500V

100W 1000W

All outputs have positive polarity! (three-output model), equipped with a delay function that can change the timing of on/off of the output.

Compact Multi-Output DC Power Supply
PMX-Multi
LAN USB RS232C
192 to 222W
P.28 to 29
2CH : +32V +32V
3CH : +32V +32V +6V
4CH : +32V +32V +18V +18V

Multi Channel Tracking DC Power Supply
PMP
option USB option GPIB option RS232C
119 to 138W
P.30
3CH : +18V +18V +6V
3CH : +25V +25V +6V
4CH : +16V -16V +25V +6V

MULTI-OUTPUT POWER SUPPLY
(LINEAR)

High Reliability DC Power Supply
PAN-A
option GPIB option RS232C

Best-selling product for benchtop use with great reliability and performance!

For high-speed simulation through four-quadrant operation. Also, able to operate as an amplifier.

PROGRAMMABLE POWER SUPPLY
(SWITCHING+LINEAR)

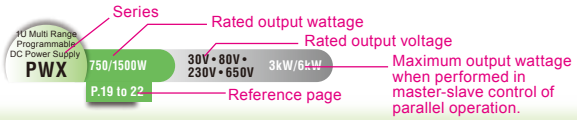
Sequence Function

Programmable Bipolar Power Supply
PBZ
option LAN USB GPIB RS232C
400W
P.33 to 34
±20V • ±40V • ±60V • ±80V
★Power factor correction circuit

Peak Current

Programmable Bipolar Power Supply
PBZ20-20A
option LAN USB GPIB RS232C
400W
P.35
±20V
★Power factor correction circuit

● How to use a chart



SWITCHING

400/800/1200/2000W — P.12 to 14 — 40V • 80V • 240V • 650V — 4kW

800/1600W — P.15 to 16 — 80V • 320V • 650V — 8kW

10V • 20V • 36V • 60V • 100V • 160V • 320V • 650V — 4.8kW

750/1500W — P.19 to 22 — 30V • 80V • 230V • 650V — 3kW/6kW

High-Capacity Variable-switching Power Supply **PAT-T**

option LAN | option USB | option GPIB | RS232C

★Power factor correction circuit
*The 850 V model applied up to the 16 kW system

4kW/8kW — P.23 to 25 — 20V • 30V • 40V • 60V • 80V • 160V • 250V • 350V • 500V • 650V • 850V • 1000V • 1500V — 40kW

8 kW high-capacity power supply with a 19-inch width and 3U height
Also, equipped with a built-in power factor correction circuit!

LINEAR
(SERIES REGULATOR SYSTEM)

2kW 4kW 12kW 60kW

Best-selling high-capacity dropper with great reliability and performance!

High Reliability High-Capacity DC Power Supply **PAD-LA**

option GPIB | option RS232C

1600 to 3750W — P.32 — 16V • 36V • 60V • 72V • 110V • 250V — 11.2kW

160 to 1200W — P.31 — 16V • 35V • 60V • 70V • 110V • 160V • 250V • 350V • 600V — 3.6kW

LINEAR
(SERIES REGULATOR SYSTEM)

High Power Intelligent Bipolar Power Supply **PBZ SR**

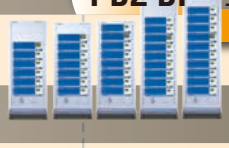
LAN | USB | GPIB | RS232C

±20V • ±40V ±60V • ±80V — 2kW — P.36

High Power Intelligent Bipolar Power Supply **PBZ BP**

LAN | USB | GPIB | RS232C

±20V ±40V — 4kW — P.37



4kW

Rack mounting, various kinds of remodeling and special orders are available!

We accept rack mounting with a user's request, various kinds of remodeling and special orders. In particular, we have accepted many DC power supplies over 20 kW and special power supplies to which overrating rush current can be applied. Also, please feel free to make an order to us regarding power supplies and systems that are not in the catalog.

Please contact us first!

Compact Wide-Range DC Power Supply (CV/CC)

PWR-01 Series

LAN LXI USB GPIB (OPTION) RS232C DRIVERS CE

*Refer to page 8

Dimensions / Weight

400 W model: 71(2.80″)W×124(4.88″)H×350(13.78″)Dmm(inch)/ 3 kg(6.61 lb)
800 W model: 142.5(5.61″)W×124(4.88″)H×350(13.78″)Dmm(inch)/ 5.5 kg(12.13 lb)
1200 W model: 214(8.43″)W×124(4.88″)H×350(13.78″)Dmm(inch)/ 7.5 kg(16.53 lb)
2000 W model: 428.5(16.87″)W×128(5.04″)H×350(13.78″)Dmm(inch)/13 kg(28.66 lb)

Accessories

Chassis connection short bar, Output terminal M4 screws (2 pcs.), Output terminal bolt set (2 sets) *Only L type and ML type included., Output terminal cover, Packing list, Safety Information, Quick Reference (Japanese/English), CD-ROM
400 W/800 W model: Power cord *1 *2
1200 W model: Input terminal cover, Ferrite core set

*1 Power cord is not included for the 1200 W model. Please purchase the optional accessory separately (AC5.5-3P3M-M4C-VCTF). Not CE certified product.
*2 Power cord is not included for the 2000 W model. Please purchase the optional accessory separately (AC5.5-1P3M-M6C-3S).

New flagship bench-top DC power supply

The PWR-01 is a series of high performance, multifunctional, compact, wide-range DC power supplies. It consists of 16 models in total with 4 maximum voltage outputs (L, ML, MH, and H) and 4 maximum power outputs (400 W, 800 W, 1200W and 2000 W). With the PWR-01 series you can set sequences with an embedded CPU as well as analog control. The series is equipped with LAN (LXI), USB, and RS232C as standard interfaces that are essential for system integration. The PWR-01 also features front-facing output terminals, variable internal resistance, bleeder ON/OFF functions, a CC/CV priority switching function, synchronized operation, various protections, and programmable internal memory.

Features

- Sequence function (supports triggered synchronization)
- Variable internal resistance function
- LAN (LXI compliant) /USB/RS232C as standard interface
- A virtual multi-channel bus (VMCB) function makes multi-channel operation more efficient
- A wide range of voltage and current settings can be combined within its output power rating (3 to 4 times)
- All models are equipped with front-facing output terminals as standard (maximum 10 A)
- Supporting universal input voltage (85 V to 265 V)
- CONFIG setting shortcut function and display (Up to three parameters can be registered.)
- Setting preset memory function (3 combinations of settings for voltage, current, OVP, OCP, and UVL)
- Bleeder (sink) can be turned ON/OFF, with an even stronger bleeder mode setting available
- Output ON/OFF delay function
- Soft start/stop function
- Operating temperature guaranteed up to 50 °C (122 °F). (Storage temperature is -25 °C to +60 °C (-13 °F to 140 °F).)

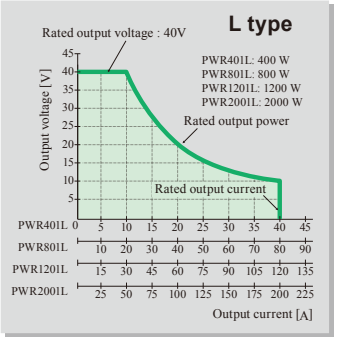
Specifications

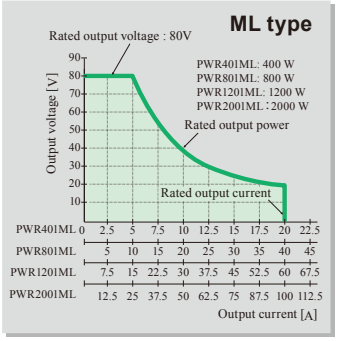
Model	Output			Ripple noise		Line regulation		Load regulation		Other			
	CV	CC	Rated power	CV	CC	CV	CC	CV	CC	Input current	Input power	Inrush current	Weight
	V	A(Rating)	W	mVrms	mArms	mV	mA	mV	mA	AC(100 V /200 V)A	VA (MAX)	Apeak (Max)	kg/lb
PWR401L	40	40	400	5	80	±6	±6	±6	±13	5.6/2.8	560	25 or less	3.0/6.61
PWR401ML	80	20		5	40	±10	±4	±10	±9				
PWR401MH	240	5		20	12	±26	±2.5	±26	±6.0				
PWR401H	650	1.85		50	6	±67	±2.2	±67	±5.4				
PWR801L	40	80	800	5	160	±6	±10	±6	±21	11.2/5.6	1120	50 or less	5.5/12.13
PWR801ML	80	40		5	80	±10	±6	±10	±13				
PWR801MH	240	10		20	24	±26	±3	±26	±7.0				
PWR801H	650	3.70		50	12	±67	±2.4	±67	±5.7				
PWR1201L	40	120	1200	5	240	±6	±14	±6	±29	16.8/8.4	1680	75 or less	7.5/16.53
PWR1201ML	80	60		5	120	±10	±8	±10	±17				
PWR1201MH	240	15.0		20	36	±26	±3.5	±26	±8.0				
PWR1201H	650	5.55		50	18	±67	±2.6	±67	±6.1				
PWR2001L	40	200	2000	5	400	±6	±22	±6	±45	28.0/14.0	2800	125 or less	13/28.66
PWR2001ML	80	100		5	200	±10	±12	±10	±25				
PWR2001MH	240	25		20	60	±26	±4.5	±26	±10				
PWR2001H	650	9.25		50	30	±67	±2.9	±67	±6.9				

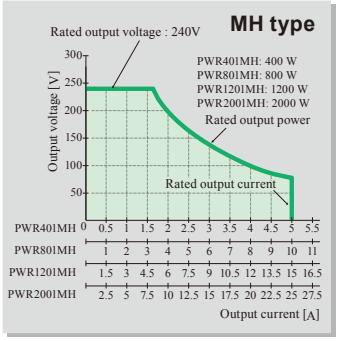
Operation Area

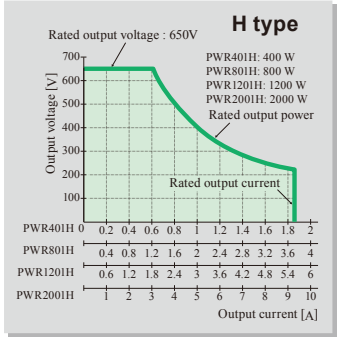
■ 3 to 4 times ratio power operation

This operating range covers a wide variety of voltage and current setting combinations.
For example, the 1200 W model PWR1201ML is capable of seamless operation within ranges of 80 V/15 A to 20 V/60 A.









Options

■ AC power cord for 1200 W model
AC5.5-3P3M-M4C-VCTF
*Not CE certified product

■ AC power cord for 2000 W model
AC5.5-1P3M-M6C-3S


AC5.5-3P3M-M4C-VCTF

■ J1/ J2 connector plug kit
OP01-PWR-01

A plug kit for externally controlling the PWR-01 through the J1/J2 connector. (30 pin pieces, Housing for the J1 connector and J2 connector, 1 piece each)

■ Parallel-operation cable
(for 2 units in parallel)
OP02-PWR-01

■ External-control cable and connector set
OP03-PWR-01

Cables 20 pcs., length: approx. 500 mm (Crimped on one end)
Housing for the J1 connector and J2 connector: 1 piece each,
Core: 1 piece

■ RS232C control-conversion cable
RD-8P/9P


RD-8P/9P

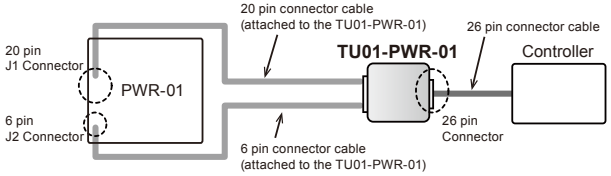
■ Safety plugs
TL41 (screw connection type)
TL42 (solder connection type)


TL41


TL42

■ Terminal unit
TU01-PWR-01

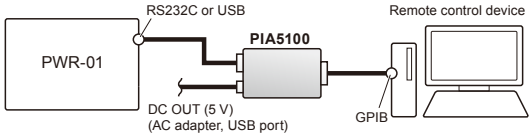
A terminal unit for converting the J1 and J2 connectors of this product to the J1 connector of the Kikusui PWR Series Regulated DC Power Supplies.



■ GPIB converter
PIA5100

This converter converts RS232C or USB of the PWR-01 to GPIB, enabling connection of a remote controller using GPIB.
[Accessories: Power cord set, Magnetic sheet]
*DC 5 V (power supply with commercially-available universal AC adapter etc.) is required to operate the PIA5100.

[Connection example]



*For the details, please refer to page 42.

■ Sequence Creation Software
SD027-PWR-01 (Wavy for PWR-01)

*Compatible with 400 W, 800 W, 1200 W models only. (2000 W models to be covered later.)

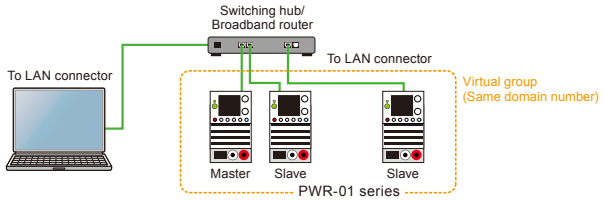
Common Specifications

Nominal input rating	100 Vac to 240 Vac, 50 Hz to 60 Hz, single phase
Input voltage range	85 Vac to 265 Vac
Input frequency range	47 Hz to 63 Hz
Input power factor(TYP)	0.99 (input voltage: 100 V), 0.97 (input voltage: 200 V)
Efficiency(TYP)	75 %
Output hold time	20 ms or more
Protection function	OVP (over voltage protection), OCP (over current protection), FOCP (Front-panel output terminal overcurrent protection), UVL (Undervoltage limit), OHP (over heat protection), SENSE (Incorrect sensing connection protection), AC-FAIL (Low AC input protection), SD (Shutdown), POWER LIMIT, watchdog (Communication monitoring), PRL ALM (Master-slave parallel operation protection)
Monitor signal output	V MON (Voltage monitor): Selectable monitor voltage range: 0 V to 5 V or 0 V to 10 V I MON (Current monitor): Selectable monitor voltage range: 0 V to 5 V or 0 V to 10 V
Status signal output	OUTON STATUS, CV STATUS, CC STATUS, ALARM STATUS, POWER ON STATUS
External control	VPGM (Output voltage control): 0 % to 100 % of the rated output voltage Selectable control voltage range: 0 V to 5 V or 0 V to 10V IPGM (Output current control): 0 % to 100 % of the rated output current Selectable control voltage range: 0 V to 5 V or 0 V to 10 V OUTPUT ON/OFF, SHUT DOWN, ALM CLR
Master-slave parallel operation	400 W, 800 W model: Up to three units (same models) including the master unit. 1200 W, 2000 W model: Up to two units (same models) including the master unit.
Operating temperature	0 °C to +50 °C (32 °F to +122 °F)
Operating humiditye	20 %rh to 85 %rh (no condensation)
Storage temperature	-25 °C to +60 °C (-13 °F to 140 °F)
Storage humidity	90 %rh or less (no condensation)

Equipped with standard LAN interface and VMCB function to support network-based remote control and monitoring

The PWR-01 series is equipped with LAN, USB, and RS232C interfaces as standard features. The virtual multi-channel bus (VMCB) feature allows for remote control and monitoring for 1-to-N as well as N-to-M in large-scale networks. In particular, the LAN interface is LXI compliant, enabling you to easily control and monitor the power supply through a browser on a PC, smartphone, or tablet by accessing the web server built into the PWR-01 series.

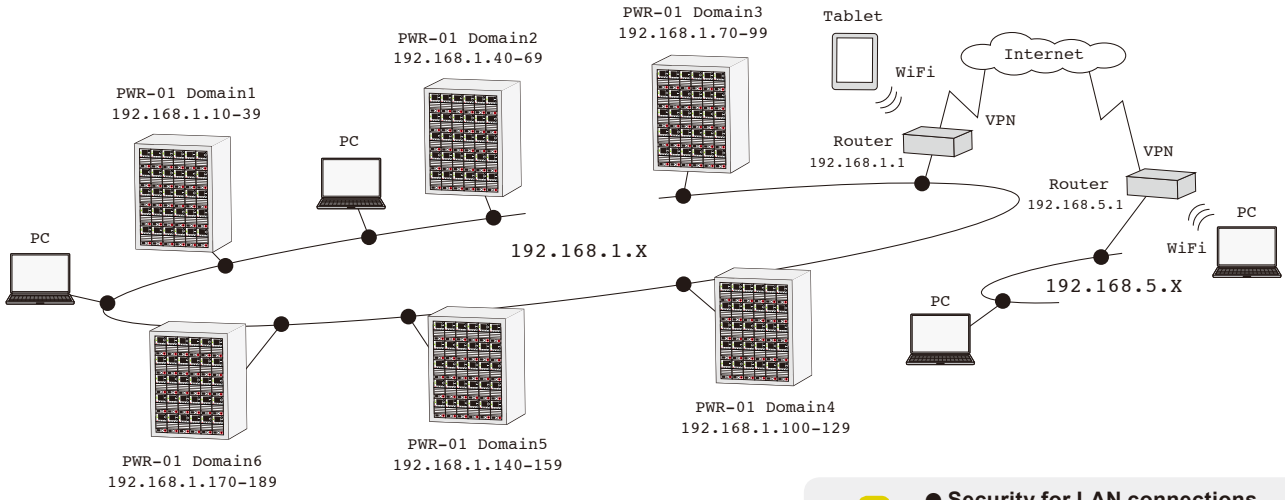
● Basic configuration with LAN interface and VMCB (example)
As shown in the figure below, it is possible to connect a PC and the PWR-01 series with a hub to create a virtual group using a LAN connection. A maximum of 254 virtual groups can be set, and the maximum number of units can be configured up to 31 units per group. A group can have a mixture of models.



Configuration	IP address	Domain number	Channel number
Master	192.168.1.1	1	0
Slave	192.168.1.2	1	1
	192.168.1.3	1	2

A DHCP server can also establish settings automatically

[Schematic LAN network configuration with the PWR-01 series power supply]



● Security for LAN connections
Access to the built-in web server can be restricted with a password.

■ Easy access with the built-in web server

Use a browser from a PC, smartphone, or tablet to access the web server built into the PWR-01 series for convenient control and monitoring.

Use latest browser version.
(Recommended browsers: Internet Explore, Chrome, or Safari)

* Connecting with a smartphone, tablet, etc. requires a Wi-Fi environment (wireless LAN router etc.).

Wide Range DC Power Supply (CV/CC) * While Supplies Last

PWR Series

USB OPTION GPIB OPTION RS232C OPTION CE *Refer to page 8

TYPE II (800 W TYPE)

TYPE III (1600 W TYPE)

Dimensions / Weight

Type II: 214(8.43″)W × 124(4.88″)H × 400(15.75″)Dmm(inch) / 8kg(17.64 lbs.)
Type III : 428.5(16.87″)W × 128(5.04″)H × 400(15.75″)Dmm(inch) / 15kg(33.07 lbs.)

Accessories

Operation manual, TP-BUS connector, Output terminal screws (M4, M8), Output protection cover
Type II : 3 m power supply cable with 3-pin plug
Type III: 3 m power supply cable with no plug, Cable clamp

Three types of wide-range power supplies covering 80 V to 650 V

The PWR Series offers constant voltage (CV)/constant current (CC) automatic crossover DC power supplies that enable you to combine a wide range of voltages and currents within the output power rating. For example, the model that has an output power rating of 1600 W (PWR1600L) provides a seamless operation range from 80 V - 20 A to 16 V - 100 A. With a single PWR Series power supply alone, you can cover an extensive output range equivalent to what is provided by three to six conventional single range DC power supplies. L type can output up to 160 % of the output current rating (in the continuous and intermittent extended operation areas). PWR1600L supports a maximum output of 10 V - 160 A.

Features

- Supports a digital communication function (TP-BUS) as standard
- Analog external control functions are available, providing voltage- and resistance-based output voltage and current controls
- Comes standard with the remote monitoring function. External analog monitoring can be done with respect to the output voltage, output current, and operation mode
- A built-in power factor correction circuit (with power factor 0.98) for harmonic current suppression, as well as a highly efficient switching circuit (efficiency 70 %)
- A four-digit display can display the voltage, current, and power (W)
- Front-side output terminals (up to 30 A) for desktop use
- A universal AC input supports a range of voltages from 100 V to 240 V

Functions

■ Seamless five times variable voltage/current range (Note: For H type, 3.25-time variable voltage/current range)

A single PWR Series power supply supports an extensive operation range, covering an output range equivalent to what is provided by several conventional single range DC power supplies. Also, the maximum output powers of the power supplies of this series are 800 W and 1600 W - slightly higher than those of their predecessors. You can conduct tests without worrying about power limits.

■ Best for testing a wide variety of high-voltage devices including margin tests

The maximum output voltage of L type is 80 V. For example, 150 % of 42 V (63 V) can be supplied for testing vehicular electrical components, or 150 % of 48 V (72 V) can be supplied for testing communication equipment. In addition, the M type (320 V) is suitable for checking designs of energy-saving circuits for flat display panels and the development of new materials, while the H type (650 V) can be used to test various components and devices that use high voltages such as automotive devices, photovoltaic inverters, and many more.

■ Two extended operation areas where up to 160 % of the output current rating can be output (L type only)

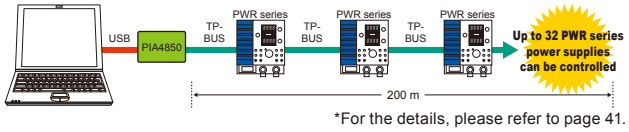
In the extended operation areas, the power supply can output up to 160 % of the output current rating. This feature is convenient when testing an automobile motor or other load device that requires high current at startup time. Since the power supply can output continuous current up to 120 % of the output current rating with the restricted ambient temperature range and current up to 160 % of the output current rating with the restricted output time tests can be conducted with a power capacity one rank lower. This feature also helps you cut equipment costs and save floor space.

■ Parallel or serial operation

Parallel operation enables multiple power supplies of the same model to operate in parallel, offering a large capacity of up to 8 kW (when five 1600-watt models are connected in parallel). In a serial operation, the voltage can be increased up to 160 V.
(Note: • Parallel and serial operations cannot be done at the same time.
• Serial operations are not possible for the M and H types.)

■ Up to 32 PWR series power supplies can be controlled with one GPIB address

The PWR Series supports a digital communication function (TP-BUS) as its standard feature. When used with a power supply controller (PIA4850) to be purchased separately, the function enables up to 32 PWR Series power supplies to be controlled using USB interface. In addition, the sequence generation software (Wavy for PAS & PWR), also to be purchased separately, allows even those users who have no knowledge of any programming language to exert output control over the PWR Series power supplies with sequence patterns of their choice and to read resultant data through the use of a PC.
(Note: For controlling via GPIB or RS232C, please use PIA4830.)



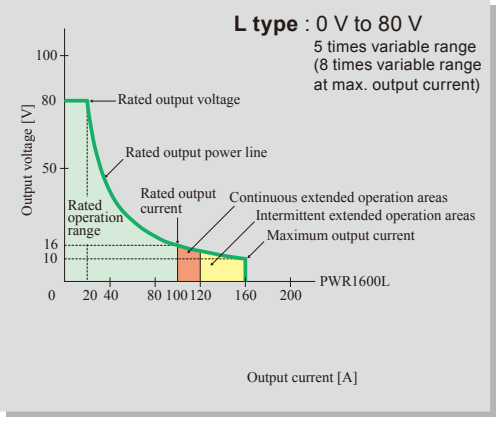
*For the details, please refer to page 41.

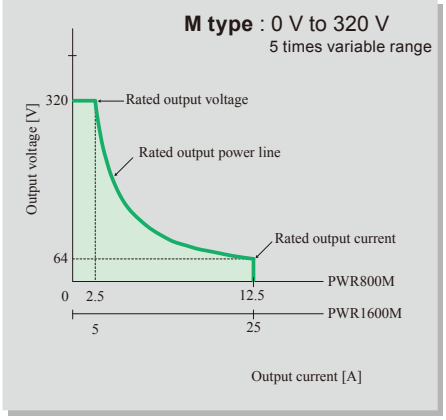
The Low Leakage Current type (LLC model) is available.

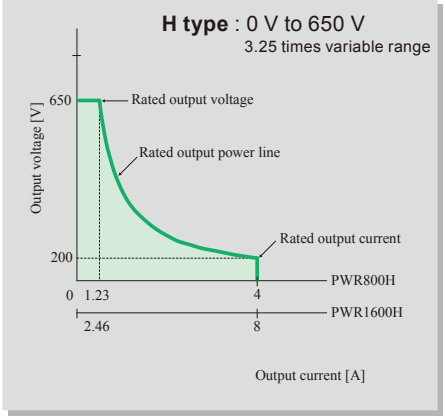
Because of the PWR series is equipped with a noise filter for the primary input, when using multiple quantities of the PWR series at the same time, the leakage breaker or the like may be activated depending on the environment of the input power. In such cases, we can offer the Low Leakage Current (LLC) type for those customers who are planning to use multiple quantities of the PWR series at the same time. For details, please contact our distributor or agent. Please note that the Low Leakage Current (LLC) type is not applied for the CE marked products.

Operation Area

Note: The ambient temperature and output time are restricted in the extended operation areas.







Options

■ Accessory kit

OP01-PAS

(used for the connection of J1 connector on the rear panel when operating by external control)

- Connector, Semi-cover, Pin 10 pcs., Ground cable

■ Carrying handle (for 400 W model)

CH01-PWR

■ Sequence creation software

Wavy for PAS & PWR

Specifications

Model	Output				Constant Voltage								
	CV	CC	CC	Rated Power	Line Regulation	Load Regulation	Ripple	Noise	Temperature Coefficient	Transient Response Time	Rise Time MAX (Standard)	Fall Time MAX (Standard)	
	V	A (Rating)	A (Max)	W	0.05 %+mV	0.05 %+mV	mV rms	mV p-p	ppm/˚C	ms	ms	ms [rated load]	ms [no load]
PWR1600L	0 to 80	0 to 100	160	1600	3	5	20	120	100	2	100 (50)	100 (40)	250 (125)
PWR800M	0 to 320	0 to 12.5	-	800			20	140		8	160 (80)	560 (280)	2200 (1400)
PWR1600M		0 to 25	-	1600			25	190		12			
PWR800H	0 to 650	0 to 4	-	800			30	210		7	260 (130)	640 (340)	2600 (1600)
PWR1600H		0 to 8	-	1600			40	280		8			

Model	Constant Current				Display Function			Other						
	Line Regulation	Load Regulation	Ripple	Temperature Coefficinet	Voltmer	Ammeter	Wattmeter	Input Current	Input Power	Input Power Factor	Power Efficiency	Inrush Current	Dimensions	Weight
	0.1 %+mA	0.1 %+mA	mA rms	ppm/˚C	(MAX)	(MAX)	(MAX)	AC (100 V/200 V) A	VA	(typ)	%	Apeak (Max)	Type	kg/lb
PWR1600L	10	10	160	200	99.99	999.9	9999	26.0/13.0	2600	0.98	70	140	III	15/33.07
PWR800M			35		999.9	99.99	999.9	13.0/6.5	1300			70	II	8/17.64
PWR1600M			50			99.99	9999	26.0/13.0	2600			140	III	15/33.07
PWR800H			20		999.9	9.999	999.9	12.0/6.0	1200			70	II	8/17.64
PWR1600H			40			9.999	9999	24.0/12.0	2400			140	III	15/33.07

* For the PWR series, the low leakage current type (LLC model) is also available. For more information, please contact us. Please note that the Low Leakage Current (LLC) type is not applied for the CE marked products.

Common Specifications

Protection function ····· OVP (over voltage protection), OCP (over current protection), POWER LIMIT, OPP (over power protection), OHP (over heat protection)

External analog control ···· CV mode
External voltage: CV external voltage control (0 V to 10 V)
External resistance: CV external resistance control, normal and fail-safe (0 Ω to 10 kΩ)
CC mode
External voltage: CC external voltage control (0 V to 10 V)
External resistance: CC external resistance control, normal and fail-safe (0 Ω to 10 kΩ)
ON/OFF: OUTPUT ON/OFF, SHUT DOWN (TTL level)

External digital control ····· TP-BUS included as standard

Parallel operation ····· Up to 5 units including master (of same model)

Serial operation (L type only) ····· Up to 2 units including master (of same model)

Monitor signal output ····· V MON (voltage monitor): 10.00 V ±0.25 V during rated voltage output
I MON (current monitor): 10.00 V ±0.25 V during maximum current output

Status signal output ····· OUT ON, CV, CC, ALM, PWR OFF, PWR ON (J1 connector, photocoupler/open-collector output)

Input voltage range ····· 85 VAC to 250 VAC, single-phase, 47 Hz to 63 Hz (no switching between 100-VAC and 200-VAC systems)

Power interruption hold-up time (min.)
····· 10 ms at 50 % load, 5 ms at rated load

Operating Ambient temperature
····· 0 °C to 50 °C (With output current derating.
L type: 45 °C or higher/M and H types: 40 °C or higher)

Operating ambient humidity ···· 20 % rh to 85 % rh (non-condensing)

Compact Variable-switching Regulated DC Power Supply (CV/CC)

PAV Series

LAN OPTION USB RS232C RS485 CE

*Refer to page 8

High power density up to 800 W in Palm-sized power supply with high performance switching system.

The PAV series is a compact, high power density, high performance constant voltage (CV) / constant current (CC) variable switching power supply. The PAV consists of 64 models total*1 with 4 types of maximum power outputs at 200 W, 400 W, 600 W and 800 W and output voltages from 10 V through 650 V. All models are standardized to a same size with 2U high (approximately 88 mm) and have high power density for bench-top use. The PAV series allows sequence settings with an embedded CPU as well as analog control. Parallel operation (up to 6 units)*2 and synchronized operation features are employed to allow extended output current. The PAV series is equipped standard with USB, RS232C and RS485 as communication interfaces which are essential for system upgrades. LAN*3 interface is also available as an option. A harmonic current control circuit is embedded with a power factor of 0.99 to take power environment into account.

*1 LAN model included (with LAN) *2 The PAV series with the same rating *3 factory option

Dimensions

70(2.76″)W × 83(3.27″)H × 350(13.78″)Dmm(inch)

Accessories

Setup Guide, Quick Reference (1 English copy, 1 Japanese copy), Safety Information, Power cord, RS485 link cable, CD-ROM
Type Ⅰ: Bus bar screw set, Bus bar cover (top and bottom), PT screws, J1, J2, and J3 connector cover, Connector housing 12P, Connector housing 8P, Connector housing 4P, Contact pins
Type Ⅱ: Output terminal plug 4P, Output terminal cover (top and bottom), PT screws, Connector housing 12P, Connector housing 8P, Connector housing 5P, Contact pins

Features

- 2U bench-top type
- Palm-sized, portable power supply
- Output power: 200 W / 400 W / 600 W / 800 W 4 models
- Output voltage: 10 V to 650 V 8 models
- USB/RS232C/RS485 as standard interface
  *LAN is a factory option
- 64 models total (LAN model included)

Specifications

Type	Specifications	Output		Ripple		Line regulation		Load regulation		Dimensions	Weight	AC input	
	Model	CV	CC	CV	CC	CV	CC	CV	CC	Type	Approx.	voltage	current*
		V	A	mVrms	mArms	mV	mA	mV	mA		kg (lbs)	V	A
200W	PAV10-20	0 to 10	0 to 20	5	25	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	2.65/1.31
	PAV20-10	0 to 20	0 to 10	6	15	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	2.62/1.29
	PAV36-6	0 to 36	0 to 6	6	8	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	2.76/1.37
	PAV60-3.5	0 to 60	0 to 3.5	7	4	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	2.69/1.33
	PAV100-2	0 to 100	0 to 2	8	3	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	2.55/1.26
	PAV160-1.3	0 to 160	0 to 1.3	10	1.2	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	2.64/1.30
	PAV320-0.65	0 to 320	0 to 0.65	25	0.8	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	2.64/1.30
	PAV650-0.32	0 to 650	0 to 0.32	60	0.5	0.01%	0.02%	0.01%	0.15%	II	2 (4.4)	85 to 265	2.64/1.30
400W	PAV10-40	0 to 10	0 to 40	5	70	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	5.05/2.47
	PAV20-20	0 to 20	0 to 20	6	40	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	4.98/2.45
	PAV36-12	0 to 36	0 to 12	6	15	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	5.25/2.57
	PAV60-7	0 to 60	0 to 7	7	8	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	5.10/2.50
	PAV100-4	0 to 100	0 to 4	8	3	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	4.80/2.37
	PAV160-2.6	0 to 160	0 to 2.6	10	1.5	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	5/2.44
	PAV320-1.3	0 to 320	0 to 1.3	25	1	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	5/2.44
	PAV650-0.64	0 to 650	0 to 0.64	60	0.6	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	5/2.44
600W	PAV10-60	0 to 10	0 to 60	5	150	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	7.48/3.69
	PAV20-30	0 to 20	0 to 30	5	75	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	7.22/3.56
	PAV36-18	0 to 36	0 to 18	5	25	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	7.70/3.80
	PAV60-10	0 to 60	0 to 10	12	8	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	7.13/3.52
	PAV100-6	0 to 100	0 to 6	15	5	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	7.13/3.52
	PAV160-4	0 to 160	0 to 4	10	2	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	7.47/3.69
	PAV320-2	0 to 320	0 to 2	30	1.5	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	7.47/3.69
	PAV650-1	0 to 650	0 to 1	60	1	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	7.59/3.75
800W	PAV10-72	0 to 10	0 to 72	5	180	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	9.00/4.45
	PAV20-40	0 to 20	0 to 40	5	100	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	9.65/4.75
	PAV36-24	0 to 36	0 to 24	5	31	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	10.30/5.10
	PAV60-14	0 to 60	0 to 14	12	28	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	10.00/4.95
	PAV100-8	0 to 100	0 to 8	15	12	0.01%+2	0.01%+2	0.01%+2	0.01%+5	I	2 (4.4)	85 to 265	9.5/4.7
	PAV160-5	0 to 160	0 to 5	10	2	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	9.34/4.61
	PAV320-2.5	0 to 320	0 to 2.5	30	1.5	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	9.34/4.59
	PAV650-1.25	0 to 650	0 to 1.25	60	1	0.01%	0.02%	0.01%	0.09%	II	2 (4.4)	85 to 265	9.43/4.66

*Input voltage 100 Vac/200 Vac, at the rated output power, ambient temperature 25°C, If the LAN option is built in, the efficiency decreases by 0.5% and the input current increases by 0.5%.

Functions

■ Multi-output system configuration

A variable power supply system of up to 31 channels can be configured using the built-in USB/RS232/RS485 ports. A LAN port can be included as a factory option.

■ Control using serial communication (USB/RS232/RS485)

The following items can be controlled through the serial ports.

- Output voltage setting
- Output current setting
- Output voltage measurement
- Output current measurement
- Output on/off
- Foldback protection setting
- Overvoltage protection (OVP) setting and readout
- Undervoltage protection (UVP) setting and readout
- Undervoltage limit (UVL) setting and readout
- Start mode setting (auto or safe)

■ Control and monitoring using analog signals

The output voltage and current can be controlled by applying analog voltage or external resistance through the external control terminal on the rear panel. In addition, the output voltage and current can be monitored by monitoring the terminal voltage.
Further, the output on/off state can be controlled, and the operating status and constant voltage/constant current (CV/CC) operation mode can be monitored.

Options

■ Power cord * The main body includes a PAV-J.

PAV/J (PSE) For Japan.
PAV/U (UL) For United States.
PAV/E (EN) For Europe.
PAV/O (plugless type)

■ Housing cover rack mount

KRA2-PAV EIA /JIS rack mount adapter
CC01-PAV Half-size housing cover
KBP2-6-PAV 1/6 width blank panel

■ RS232 and RS485 cables

PAG/485-9 RS485 cable with Dsub 9-pin and RJ-45 connectors. Length: Approx. 2 m
PAG/232-9 RS232 cable with Dsub 9-pin and RJ-45 connectors. Length: Approx. 2 m
PAG/232-25 RS232 cable with Dsub 25-pin and RJ-45 connectors. Length: Approx. 2 m

■ RS485 link cable

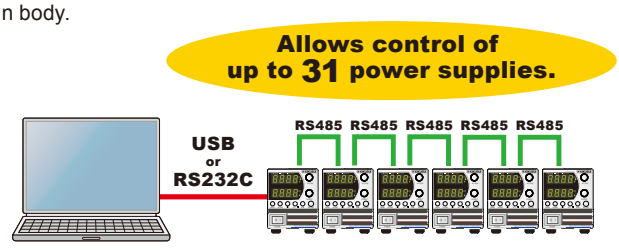
PAG/RJ45 Serial link cable with shielded RJ-45 connectors. Length: Approx. 0.5 m

■ Sequence creation software

SD024-PAV(Wavy for PAV)

■ USB/RS232C/RS485 Control

The PAV series employs USB/RS232C/RS485 interfaces as a standard. Up to 31 PAV series power supplies can be connected and controlled. The USB/RS232C/RS485 interfaces are integrated in the PAV series main body.



■ Parallel operation/Synchronized operation

Parallel operation (PAV series with the same rating) and synchronized operation (trigger synchronization) are available.
Use of optional rack-mount adapter KRA2-PAV (allows up to 6 units) and half-size integrated chassis cover CC01- PAV (allows up to 3 units) allows integration for smart rack mounting and transportation.

* Parallel operation and synchronized operation can be achieved without the optional KRA2-PAV and CC01-PAV.

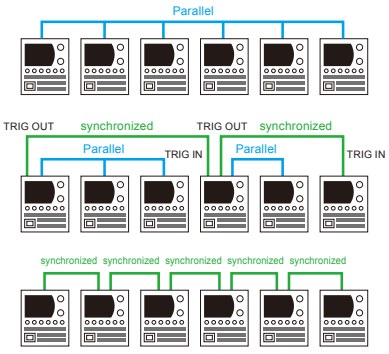
Up to 4.8 kW (up to 6 units) can be mounted into a 19-inch general-purpose rack

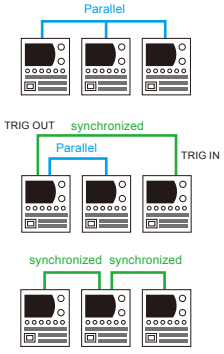
KRA2-PAV
(e.g. 6 units are mounted)

*Vacant slot without a power supply allows the mounting of an optional blank panel (KBP2-6-PAV).

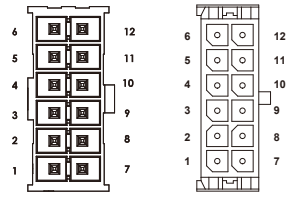
Three-in-one on the bench top is available

CC01-PAV
(e.g. 3 units are mounted)





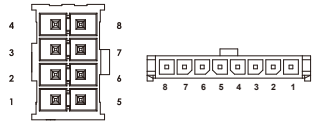
J1 connector specifications



Models whose rated output voltage is 10 V to 100 V

Models whose rated output voltage is 160 V to 650 V

J3 connector specifications



Models whose rated output voltage is 10 V to 100 V

Models whose rated output voltage is 160 V to 650 V

● J1 connector Signals and functions

Pin no.	Signal name	Function
1	LOC/REM SELECT	Local/remote switching
2	P	Current balance terminal for master-slave parallel operation
3	I_MON	Output current monitoring terminal
4	LOC/REM MON	Local/remote status output
5	IPGM	Output current control using external voltage or external resistance
6	VPGM	Output voltage control using external voltage or external resistance
7	COM	Common ground for VMON, IMON, CV/CC, and LOC/REM signals (connected internally to the negative sensing terminal (-S))
8	CV/CC	Constant voltage/constant current operation mode indication terminal (The ground is COM.)
9	COM	Common ground for VMON, IMON, CV/CC, and LOC/REM signals (connected internally to the negative sensing terminal (-S))
10	V_MON	Output voltage monitoring terminal
11	IPGM_RTN	Ground for IPGM
12	VPGM_RTN	Ground for VPGM (connected internally to the negative sensing terminal (-S))

● J3 connector Signals and functions

Pin no.	Signal name	Function
1	Aux Pin 1	General-purpose open collector output (1)
2	PS_OK	Status output terminal indicating the output state (on/shut off)
3	Trigger Out	Trigger output terminal
4	ILC	Output on/off control input terminal Output on when shorted; output off when open (isolated from the output)
5	Shut Off (SO)	Output shutoff control terminal (isolated from the output)
6	Aux Pin 2	General-purpose open collector output (2)
7	IFC_COM	J3 common ground (isolated from the output)
8	Trigger In	Trigger input terminal

1U Wide Range Programmable DC Power Supply

PWX Series

LAN USB GPIB (OPTION) RS232C DRIVERS CE LXI

*Refer to page 8

Applied to the model with remarks "" in the following specifications.

Half-rack size

Full-rack size

Dimensions / Weight

Half-rack size(PWX750ML): 214(8.43″)W X 43(1.69″)H X 437(17.20″)Dmm(inch)/ 5kg(11.02 lbs.)

Full-rack size(750 W type): 422.8(16.65″)W X 43(1.69″)H X 500(19.69″)Dmm(inch)/ 8kg(17.64 lbs.)

Full-rack size(1500 W type): 422.8(16.65″)W X 43(1.69″)H X 500(19.69″)Dmm(inch)/ 9.5kg(20.94 lbs.)

Accessories

AC cable: 1 wire, Output terminal cover: 1 pc., Output terminal M8 bolt set: M8 bolts ×2 sets(Bolt, nut, spring washer, and washer for each bolt) *PWX750ML includes M6 bolt set, Chassis connection wire: 1 wire, J1 connector plug kit: 1 set (Housing: 1 pc., Connector: 1 pc., Plug: 1 pc., Strain relief: 1 pc., Clips: 2 pcs., and two types of Screws: 2 pcs.,), Packing list: 1 copy, Quick reference (1 each for English and Japanese), Safety precautions: 1 copy, China RoHS sheet: 1 copy, CD-ROM: 1 disc, Input terminal cover set (1500 W type)*1

*1.Power cord is not included for the 1500 W type. Please purchase the optional accessory separately(AC5.5-3P3M-M4C-VCTF). *Not CE certified product

Ideal for N-to-M network-based remote control and monitoring

A Next-Generation Rack-Mounted Power Supply

The PWX series is a CVCC programmable regulated DC power supply optimally designed for rack-mounted operation. To increase its mounting efficiency, it has a 19-inch rack width with a thin shape and intakes and outtakes for cooling on only the front and back surfaces so that it can be mounted flush top and bottom.

The series is equipped standard with USB, RS232C, and LAN interfaces, which are essential for system upgrades. The series also has a virtual multi-channel bus (VMCB) function that allows it to be used efficiently for remote control and monitoring with 1-to-N and as well as with N-to-M in large-scale networks. Moreover, the PWX is an LXI (LAN eXtention for Instrumentation) compliant instrument, so it can be connected easier with the measurement system using LAN interface. You can also manage the power supply in a different building.

Two output power specifications are available: 750 W and 1500 W, and a wide range of voltage and current settings can be combined within its output power rating (3 times). For example, the output power of 1500 W model, the PWX1500ML is capable to operate seamlessly from the range of "80 V-18.75 A" to "26.8 V-56 A". The input voltage has a universal 85 V to 265 V input voltage range, and the unit also has an internal power factor correction (PFC) circuit to control the harmonic current. It also includes an analog external control/monitoring output, master-slave parallel operation function, various protective functions, and memory function.

*Half-rack model is complied with Ver. 2.0 or later

Features

- A wide range of voltage and current settings can be combined within its output power rating (3 times)
- PFC circuit of 0.99 (with 100 V) or 0.97 (with 200 V) at full load *TYP value
- Supporting universal input voltage (85 V to 265 V)
- LAN (LXI compliant) /USB/RS232C as standard interface
- A virtual multi-channel bus (VMCB) function makes multi-channel operation more efficient
  *Half-rack model is complied with Ver. 2.0 or later
- Emulation setting, Command language setting function
- A thin and lightweight design with a 1U height for increased rack-mounting efficiency
- Expandable output capacity by parallel operation
- Expandable output voltage by series operation (up to 2 units by the same model)
  *Excluding the PWX750HF and the PWX1500H.
- External analog control function (Output control based on voltage and resistance; ON/OFF based on contact signals)
- Analog monitor output (output voltage, output current, and operating mode can be monitored)
- Various protection functions: overvoltage protection, overcurrent protection, and overheat protection
- Memory function (3 combinations of settings for voltage, current, OVP, OCP, and UVL)
- Remote sensing function
- Bleeder circuit ON/OFF setting (to prevent over-discharging of batteries)
- CV, CC priority start function (prevents overshoot with output ON)

Specifications

Model	Output		Input Current	Rated Power	Dimensions	Weight
	V	A	(AC 100/200 V)A	W	Type	kg/lb
PWX750ML	0 to 80	0 to 28	10.5/5.25	750	Half rack size	5/11.02
PWX750LF*	0 to 30	0 to 75			Full rack size	8/17.64
PWX750MLF*	0 to 80	0 to 28				
PWX750MHF*	0 to 230	0 to 10				7.5/16.53
PWX750HF*	0 to 650	0 to 3.5				
PWX1500L*	0 to 30	0 to 150	21/10.5	1500		9.5/20.94
PWX1500ML*	0 to 80	0 to 56				
PWX1500MH*	0 to 230	0 to 20				9/19.84
PWX1500H*	0 to 650	0 to 7				

* The CE marked products. For details, please contact our distributor or agent.

Options

■ AC power cord for 1500W model
AC5.5-3P3M-M4C-VCTF
*Not CE certified product

■ RS232C control conversion cable
RD-8P/9P

■ Sequence creation software
SD013-PWX (Wavy for PWX)

■ Parallel operation cable *
PC01-PWX (for 2 units in parallel)
PC02-PWX (for 3 units in parallel)
PC03-PWX (for 4 units in parallel)
This cable can be used only for the vertical connection of rack mount, it can not be used for the side-by-side connection of the 1U half-size model (750 W type).

■ Interface
ISO PROGRAMING VOLT CONT factory option
ISO PROGRAMING CURR CONT factory option
Note: Only one interface board can be installed.
The interface option can not be sold separately.

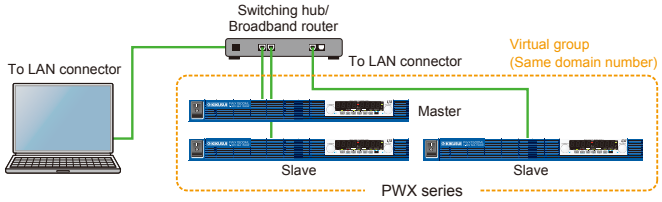
Equipped with standard LAN interface and VMCB function to support network-based remote control and monitoring

The PWX series is equipped with LAN, USB, and RS232C interfaces as standard features. The virtual multi-channel bus (VMCB)*1 feature allows for remote control and monitoring for 1-to-N as well as N-to-M in large-scale networks. In particular, the LAN interface is LXI compliant, enabling you to easily control and monitor the power supply through a browser on a PC, smartphone, or tablet by accessing the web server built into the PWX series .
Additionally, the optional application software, Wavy for PWX (SD013-PWX), sequence creation and control software, allows you to change settings for specific channels (in individual) on VMCB-connected PWX series power supplies, and lets you perform batch control using global commands*2. You can also turn the output ON and OFF on multiple units and adjust the output voltage and current.

*1: This function applies to the firmware version 2.0 and later for the PWX750ML.
*2: This is only enabled for "Direct control" on Wavy for PWX. Global commands that can be also used under control with VXI-11, HiSLIP, and SCPI-RAW.

● Basic configuration with LAN interface and VMCB (example)

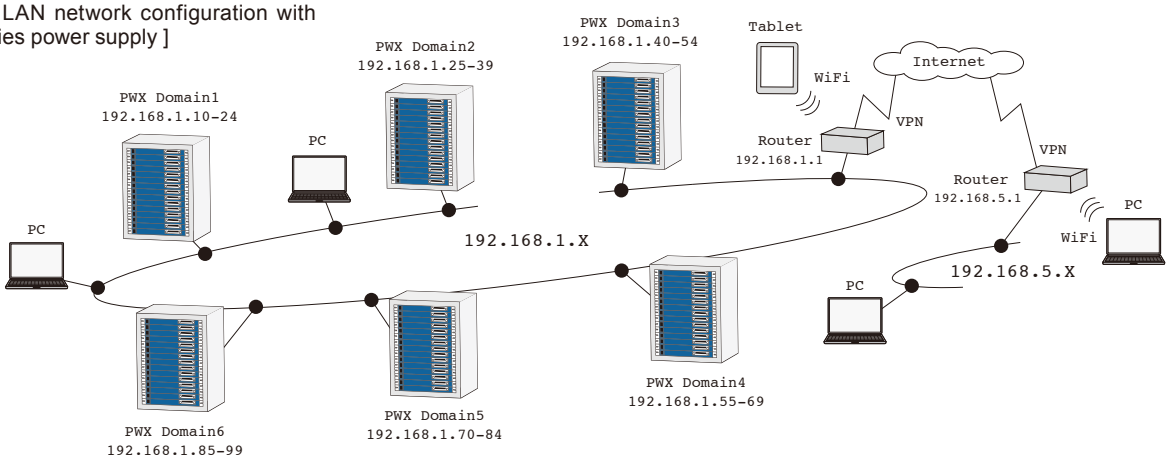
As shown in the figure below, it is possible to connect a PC and the PWX series with a hub to create a virtual group using a LAN connection. A maximum of 254 virtual groups can be set, and the maximum number of units can be configured up to 31 units per group. A group can have a mixture of models.



Configuration	IP address	Domain number	Channel number
Master	192.168.1.1	1	0
Slave	192.168.1.2	1	1
	192.168.1.3	1	2

A DHCP server can also establish settings automatically

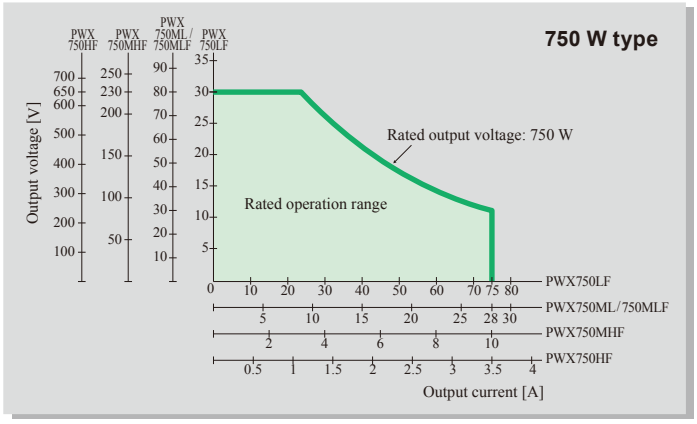
[Schematic LAN network configuration with the PWX series power supply]

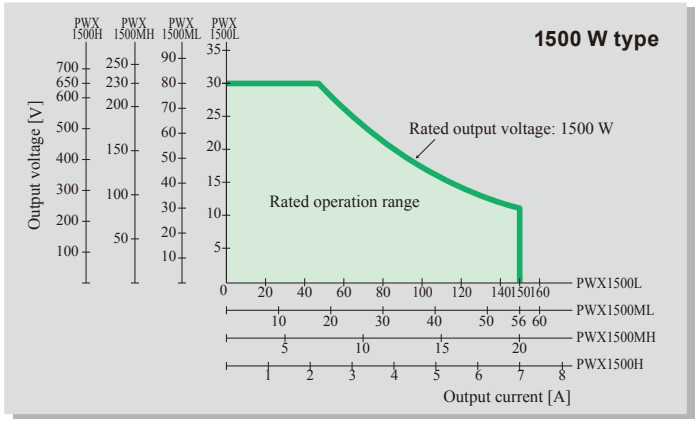


● Security for LAN connections

Access to the built-in web server can be restricted with a password. Also, when using VXI-11, HiSLIP, and SCPI-RAW for control, host restrictions can be set with the IP address. It is possible to prevent access from any terminal other than the ones registered as a host (up to 4 hosts can be registered).

Operation Area



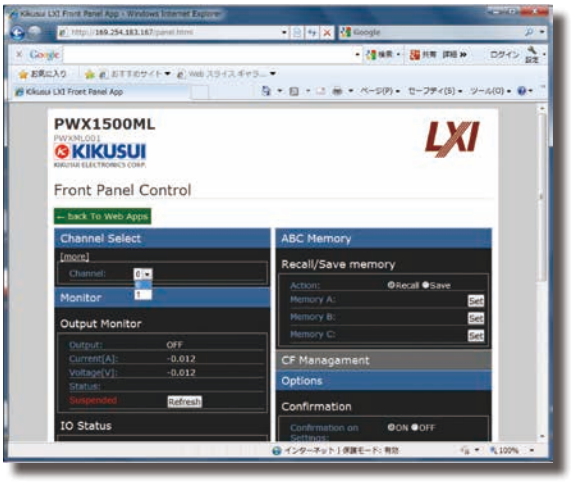


■ Easy access with the built-in web server

Use a browser from a PC, smartphone, or tablet to access the web server built into the PWX series for convenient control and monitoring.

[Recommended browser]
- Requires for the Internet Explorer version 9.0 or later
- Requires for the firefox 8.0 or later
- Requires for the safari/mobile Safari 5.1 or later
- Requires for the Chrome 15.0 or later
- Requires for the Opera 11.0 or later

* Connecting with a smartphone, tablet, etc. requires a Wi-Fi environment (wireless LAN router etc.).



Common Specifications

Protection function····· OVP (over voltage protection), OCP (over current protection), UVL (under voltage limit), OHP (over heat protection), FAN (fan failure protection), SENSE (incorrect sensing connection orotection), AC-FAIL (low AC input protecion), SD (shut down), POWER LIMIT (power limit)

External analog control····· CV mode
External voltage: CV external voltage control (0 V to 5 V/ 0 V to 10 V)*1*2
External resistance: CV external resistance control, normal and fail-safe (0 Ω to 10 kΩ)
CC mode
External voltage: CC external voltage control (0 V to 5 V/ 0 V to 10 V)*1*2
External resistance: CC external resistance control, normal and fail-safe (0 Ω to 10 kΩ)
ON/OFF: OUTPUT ON/OFF, SHUT DOWN (TTL level)*3

Parallel operation····· Up to 4 units including master (of same model)

Serial operation *6 ····· Up to 2 units (of same model)

Monitor signal output *4 ····· V MON (voltage monitor): 0 V ± 5 V/ 0 V ± 10 V during rated voltage output
I MON (current monitor): 0 V ± 5 V/ 0 V ± 10 V during maximum current output

Status signal output *5 ····· OUT ON, CV, CC, ALM, PWR ON

Input voltage range····· 100 VAC to 240 VAC, single-phase, 50 Hz to 60 Hz

Power interruption hold-up time (min.) ···20 ms or greater

Power factor (TYP)..... 0.99 (input voltage 100 V), 0.97 (input voltage 200 V)

Efficiency (MIN) ..... 74 % or more

Operating ambient temperature.. 0 °C to 50 °C

Operating ambient humidity ·· 20 % rh to 85 % rh (non-condensing)

Coolimg method ..... Forced air cooling using fan

Isolation voltage..... ± 250 Vmax: L, LF, ML, MLF
± 500 Vmax: MH, MHF
± 800 Vmax: H, HF

*1: Using optional isolated analog interface (Voltage control, factory option), it can be controlled by the power supply output and the isolated external voltage.
*2: Using optional isolated analog interface (Current control, factory option), it can be controlled with the current 4 mA to 20 mA.
*3: Using optional isolated analog interface (Voltage control/Current control, factory option), the power supply output can be isolated.
*4: J1 connector on the rear panel
*5: Photocoupler open collector output
*6: H, HF are excluded

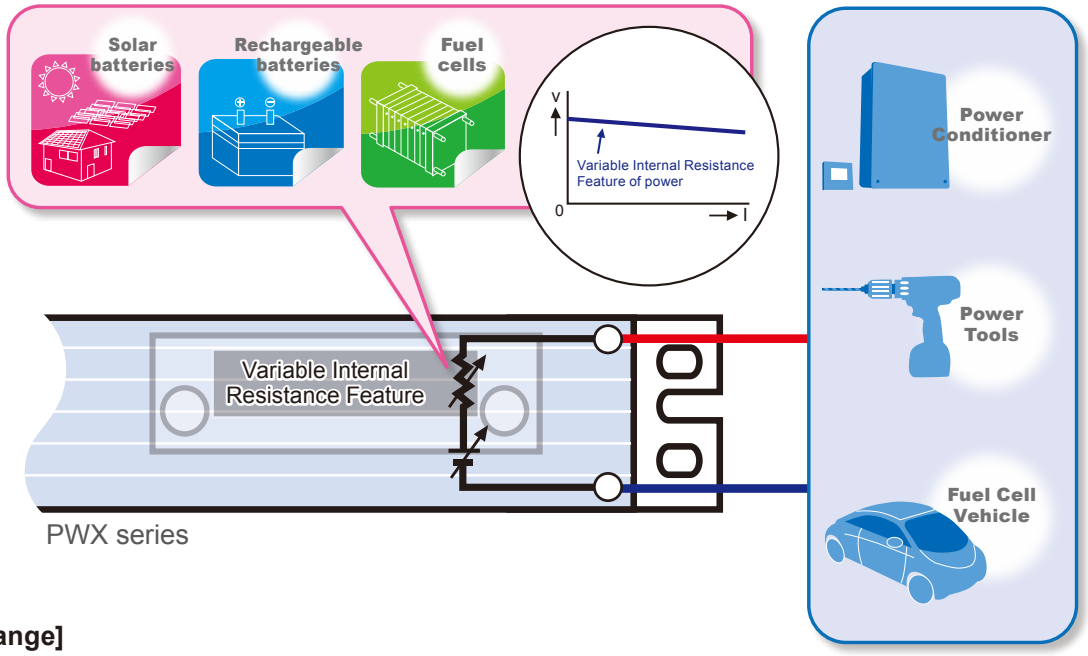
Variable Internal Resistance Feature

The variable internal resistance feature enables you to easily simulate the internal resistance of rechargeable batteries, solar batteries, fuel cells, and the like. By setting the internal resistance value in constant voltage (CV) mode, you can decrease the output voltage according to the output current.
You can use a CONFIG setting to set the internal resistance.

● Variable internal resistance feature

model			
PWX750LF	PWX750MLF	PWX1500L	PWX1500ML
PWX750MHF	PWX750HF	PWX1500MH	PWX1500H

* Factory option
* Excluding the PWX750ML



[Variable range]

Rint: Internal resistance
0 =<Rint =<Rint (max)

	PWX750LF	PWX750MLF	PWX750MHF	PWX750HF	PWX1500L	PWX1500ML	PWX1500MH	PWX1500H
Rint (min) [Ω]	0.0001 *1	0.001	0.01	0.1	0.0001 *1	0.001	0.01	0.1
Rint (max) [Ω]	0.4000 *1	2.857	23.00	185.7	0.2000 *1	1.429	11.50	92.9
Resolution [Ω]	0.0001 *1	0.001	0.01	0.1	0.0001 *1	0.001	0.01	0.1

*1 When the value is set from the front panel, the least significant digit is not shown on the panel display.
The value varies at a higher resolution than what is shown, and the least significant digit is rounded and shown in the next higher digit.

The maximum internal resistance that can be set from the front panel in parallel operation is the value obtained by dividing Rint (max) during standalone operation by the number of units in parallel operation.The resolution is the value obtained by dividing the resolution during standalone operation by the number of units in parallel operation.

[Specifications]

	PWX750LF	PWX750MLF	PWX750MHF	PWX750HF	PWX1500L	PWX1500ML	PWX1500MH	PWX1500H
Maximum internal resistance that can be set Rint (max) [Ω]	0.400	2.857	23.00	185.7	0.200	1.429	11.50	92.9

High-efficiency, High-capacity Switching DC Power Supply (CV/CC)

PAT-T Series

LAN OPTION USB OPTION GPIB OPTION RS232C DRIVERS LXI

Dimensions / Weight

430(16.93″)W × 129.2(5.09″)H × 550(21.65″)Dmm (inch)/ 26kg(57.32 lbs)

Accessories

OUTPUT terminal cover set (Output protection covers, Screws): Model of rated output 20 V to 850 V (2 sets), Output terminal bolt (Bolts, Nuts, Spring washers): PAT20-400T/PAT30-266T (M12 (2 sets)), PAT20-200T/PAT40-100T/PAT60-67T/PAT160-25T/PAT40-200T/PAT60-133T/PAT80-100T/PAT160-50T (M10 (2 sets)), PAT250-32T/PAT350-22.8T/PAT500-16T/PAT650-12.3T/PAT850-9.4T (M8(2 sets)), J1/ J2 connector kit (Protection covers, sockets, pins), Chassis connection wire set (Chassis connection wire, screw) *Chassis connection wire only for the PAT1000-8T and PAT1500-5.3T., Heavy object warning label, Setup guide, Quick reference (English/Japanese), Safety information, CD-ROM

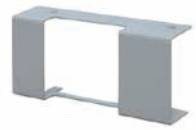
*Power cord is not included.
Please purchase the optional accessory separately(AC8-4P4M-M6C).

Options

■ Input power cable
AC8-4P4M-M6C

■ Parallel operation cable
PC01-PAT

■ Power switch guard
OP01-PAT



■ Vertical stand
VS01

*PAT-T series main unit is not included.

■ Interface board
GPIB Interface factory option
USB Interface factory option
LAN Interface factory option

Note: Only one interface board can be installed.

■ Sequence creation software
Wavy for PAT-T

Environmentally conscious, energy-saving, high-capacity power supply

The PAT-T Series is a constant voltage/constant current, auto-shifting, switching DC power supply. It features a soft switching system that offers greater efficiency and lower noise. At the same time, it makes full use of high-density packaging technology to reduce the unit's size and weight. The chassis is the standard rack width(430 mm), and is about 130 mm(3U) high and 550 mm deep. The output power is 8 kW. Compared to series regulated products of the same capacity, it is about 1/6 the volume and 1/7 the weight. While offering a high output of 8 kW despite its small cabinet size, it also features a "power factor correction circuit." With a high power factor of 0.95, it improves the power environment (suppresses harmonic currents) and also greatly contributes to "energy saving," as exemplified by its simplified and miniaturized power reception and distribution modules, and overall lower power consumption. Furthermore, an optimized heat radiation design will make operation guaranteed at ambient temperatures of up to 50 ˚C. It can thus be deployed in demanding applications where it must provide full-load, continuous operation despite high ambient temperatures. The layout of the operation/display panel is simple and intuitive and has been designed with viewability and usability in mind. An RS232C interface is provided as standard together with external analog control, monitor output, and status output connectors, enabling control from an external computer or sequencer. In addition, GPIB, USB, or LAN interface can be equipped as a factory option. The unit can either be used in a standalone configuration or can be incorporated into a test system.

Features

- Output capacity of 8 kW from a unit of standard rack width(430 mm), a height of about 130 mm(3U), and a depth of about 550 mm
- Incorporates a power factor correction circuit to improve the power environment and contribute to energy saving
- Capable of full-load, continuous operation even at an ambient temperature of 50 ˚C
- High noise resistance
- 4 kW type can operate even with single-phase 200 volt input (However, current is limited to about 75 % of rated value.)
- Can be configured in parallel with a master/slave setup to supply up to 40 kW
- Configuration memory feature lets you store and call three sets of voltage/current values
- Eight protective features to guard against overvoltage, over-current, etc
- Capable of external analog control, monitor output (voltage output and current output), and status output
- Capable of setting a delay time (0.1 to 10.0 seconds) for actual power output following the turning on of the OUTPUT switch (OUTPUT ON/OFF delay)
- The trigger function allows more freedom when measuring timing.
- Equipped with an RS232C interface as standard
- Supports USB/GPIB/LAN interface (Factory option)
- IEEE 488.2 and SCPI standard compliant interface commands
- Downloading the instrument driver from our WEB site enables you to easily control this unit from Excel VBA or Lab VIEW
- The operation of CC priority function protects the current over-shoot when the output is turned on.
- Supports 20 V to 1500 V output voltages.

Specifications

4 kW Type

Model	Output		Constant Voltage					Constant Current			Weight
	CV	CC	Ripple	Line Regulation	Load Regulation	Transient Response	Rise/Fall Time (rated load)	Ripple	Line Regulation	Load Regulation	
	V	A	mV rms	0.05 %+mV or less	0.1 %+mV or less	ms	ms	mA rms	0.1 %+mA or less	0.2 %+mA or less	kg/lb
PAT20-200T	0 to 20	0 to 200	10	5	5	5	100/100	400	30	30	20/44.09
PAT40-100T	0 to 40	0 to 100	30	5	5	5	100/100	300	30	30	19/41.89
PAT60-67T	0 to 60	0 to 67	35	5	5	5	100/100	250	30	30	18/39.68
PAT160-25T	0 to 160	0 to 25	40	5	5	5	100/100	200	30	30	18/39.68

■ Common Specifications

Input
Nominal input rated voltage .....Single-phase/three-phase 200 VAC to 240 VAC, 50 Hz to 60 Hz
* 4 kW type can operate with single-phase 200 volt input.However, current is limited to about 75 % of rated value.
Input Voltage range .....180 VAC to 250 VAC
Input frequency range .....47 Hz to 63 Hz
Efficiency .....84 % (min.) [PAT20-200T]/85 % (min.)
[at input voltage of 200 VAC and rated load]

Power factor.....0.95 (typical) [at input voltage of 200 VAC and rated load]
Input current..... Single-phase 22 A (max) [at 3 kW load]/three-phase 17 A (max) [at rated load]
Inrush current .....50 A peak (max)
Input power .....Single-phase 4 kVA (max) [at 3 kW load]/three-phase 5 kVA (max) [at rated load]

8 kW Type*1

*1: For 8 kW type models, 3-phase 400 V input is available. For details, please contact our distributor or agent.

Model	Output		Constant Voltage					Constant Current			Weight
	CV	CC	Ripple	Line Regulation	Load Regulation	Transient Response	Rise/Fall Time (rated load)	Ripple	Line Regulation	Load Regulation	
	V	A	mV rms	0.05 %+mV or less	0.1 %+mV or less	ms	ms	mA rms	0.1 %+mA or less	0.2 %+mA or less	kg/lb
PAT20-400T	0 to 20	0 to 400	10	5	5	5	100/100	500	30	30	26/57.32
PAT30-266T	0 to 30	0 to 266	20	5	5	5	100/100	400	30	30	27/59.52
PAT40-200T	0 to 40	0 to 200	30	5	5	5	100/100	400	30	30	25/55.12
PAT60-133T	0 to 60	0 to 133	30	5	5	5	100/100	350	30	30	24/52.91
PAT80-100T	0 to 80	0 to 100	30	5	5	5	100/100	300	30	30	24/52.91
PAT160-50T	0 to 160	0 to 50	30	5	5	5	100/100	200	30	30	24/52.91
PAT250-32T	0 to 250	0 to 32	50	5	5	5	100/100	200	30	30	23/50.71
PAT350-22.8T	0 to 350	0 to 22.8	50	5	5	5	100/200	200	30	30	23/50.71
PAT500-16T	0 to 500	0 to 16	100	5	5	5	100/200	200	30	30	23/50.71
PAT650-12.3T	0 to 650	0 to 12.3	100	5	5	5	100/200	150	30	30	22/48.50
PAT850-9.4T	0 to 850	0 to 9.4	100	5	5	5	100/200	120	30	30	23/50.71
PAT1000-8T (SPEC21163)	0 to 1000	0 to 8	150	5	5	5	100/200	120	30	30	23/50.71
PAT1500-5.3T (SPEC21164)	0 to 1500	0 to 5.3	200	5	5	5	100/200	120	30	30	23/50.71

■ Common Specifications

Input
Nominal input rated voltage .....Three-phase 200 VAC to 240 VAC, 50 Hz to 60 Hz
Input Voltage range .....180 VAC to 250 VAC
Input frequency range .....47 Hz to 63 Hz
Efficiency .....85 % (min.) [at input voltage of 200 VAC and rated load]

Power factor.....0.95 (typical) [at input voltage of 200 VAC and rated load]
Input current..... 32 A (max) [rated load]
Inrush current .....100 A peak (max)
Input power .....10 kVA (max)

Smart rack system (PAT-TX/TMX)

The large-current model assembles multiple PAT-T series units with special rack parts.
The PAT-TMX is a model equipped with the breaker.
A total of 82 models are available, ranging from 16 kW to 40 kW.

Model with breaker

Model without breaker

■ Lineup

How to define the model name: The first part of number indicates the rated voltage, and the second part of number indicates the rated current. ([Example] PAT20-2,000TM, rated voltage: 0 V to 20 V, rated current: 0 A to 2,000 A) The model with "X" at the end of model name is equipped with the breaker.

Output rating	16 kW type	24 kW type	32 kW type	40 kW type
20 V type	PAT20-800TM	PAT20-1200TM	PAT20-1600TM	PAT20-2000TM
	PAT20-800TMX	PAT20-1200TMX	PAT20-1600TMX	PAT20-2000TMX
30 V type	PAT30-532TM	PAT30-798TM	PAT30-1064TM	PAT30-1330TM
	PAT30-532TMX	PAT30-798TMX	PAT30-1064TMX	PAT30-1330TMX
40 V type	PAT40-400TM	PAT40-600TM	PAT40-800TM	PAT40-1000TM
	PAT40-400TMX	PAT40-600TMX	PAT40-800TMX	PAT40-1000TMX
60 V type	PAT60-266TM	PAT60-399TM	PAT60-532TM	PAT60-665TM
	PAT60-266TMX	PAT60-399TMX	PAT60-532TMX	PAT60-665TMX
80 V type	PAT80-200TM	PAT80-300TM	PAT80-400TM	PAT80-500TM
	PAT80-200TMX	PAT80-300TMX	PAT80-400TMX	PAT80-500TMX
160 V type	PAT160-100TM	PAT160-150TM	PAT160-200TM	PAT160-250TM
	PAT160-100TMX	PAT160-150TMX	PAT160-200TMX	PAT160-250TMX
250 V type	PAT250-64TM	PAT250-96TM	PAT250-128TM	PAT250-160TM
	PAT250-64TMX	PAT250-96TMX	PAT250-128TMX	PAT250-160TMX
350 V type	PAT350-45.6TM	PAT350-68.4TM	PAT350-91.2TM	PAT350-114TM
	PAT350-45.6TMX	PAT350-68.4TMX	PAT350-91.2TMX	PAT350-114TMX
500 V type	PAT500-32TM	PAT500-48TM	PAT500-64TM	PAT500-80TM
	PAT500-32TMX	PAT500-48TMX	PAT500-64TMX	PAT500-80TMX
650 V type	PAT650-24.6TM	PAT650-36.9TM	PAT650-49.2TM	PAT650-61.5TM
	PAT650-24.6TMX	PAT650-36.9TMX	PAT650-49.2TMX	PAT650-61.5TMX
850 V type	PAT850-18.8TM			
	PAT850-18.8TMX			

● Large Capacity Model (Smart Rack) < PAT-T Series > Lineup

Please refer to page 23 to 24 for product detail.

Features

These are large-capacity models that use products from the PAT-T series assembled in an exclusive rack system.

- Supports up to 40 kW and 2000 A!
- 16 kW to 40 kW capacity, with four types of racks
- Harmonic current suppression and energy savings with a built-in power factor correction circuit!
- Built-in breaker available on model names that end with an“X”
- 3-phase 200 V input and 3-phase 400 V input available
- RS232C standard; USB, GPIB, and LAN (LXI compliant) available as options
- Lineup: 164 models total (Both 3-phase 200 V input specifications and 3-phase 400 V input specifications are available for all 82 models shown in the table below.)

[Model with breaker]

[Model without breaker]

Rated Voltage	16 kW	24 kW	32 kW	40 kW
20 V	PAT20-800TM	PAT20-1200TM	PAT20-1600TM	PAT20-2000TM
	PAT20-800TMX	PAT20-1200TMX	PAT20-1600TMX	PAT20-2000TMX
30 V	PAT30-532TM	PAT30-798TM	PAT30-1064TM	PAT30-1330TM
	PAT30-532TMX	PAT30-798TMX	PAT30-1064TMX	PAT30-1330TMX
40 V	PAT40-400TM	PAT40-600TM	PAT40-800TM	PAT40-1000TM
	PAT40-400TMX	PAT40-600TMX	PAT40-800TMX	PAT40-1000TMX
60 V	PAT60-266TM	PAT60-399TM	PAT60-532TM	PAT60-665TM
	PAT60-266TMX	PAT60-399TMX	PAT60-532TMX	PAT60-665TMX
80 V	PAT80-200TM	PAT80-300TM	PAT80-400TM	PAT80-500TM
	PAT80-200TMX	PAT80-300TMX	PAT80-400TMX	PAT80-500TMX
160 V	PAT160-100TM	PAT160-150TM	PAT160-200TM	PAT160-250TM
	PAT160-100TMX	PAT160-150TMX	PAT160-200TMX	PAT160-250TMX
250 V	PAT250-64TM	PAT250-96TM	PAT250-128TM	PAT250-160TM
	PAT250-64TMX	PAT250-96TMX	PAT250-128TMX	PAT250-160TMX
350 V	PAT350-45.6TM	PAT350-68.4TM	PAT350-91.2TM	PAT350-114TM
	PAT350-45.6TMX	PAT350-68.4TMX	PAT350-91.2TMX	PAT350-114TMX
500 V	PAT500-32TM	PAT500-48TM	PAT500-64TM	PAT500-80TM
	PAT500-32TMX	PAT500-48TMX	PAT500-64TMX	PAT500-80TMX
650 V	PAT650-24.6TM	PAT650-36.9TM	PAT650-49.2TM	PAT650-61.5TM
	PAT650-24.6TMX	PAT650-36.9TMX	PAT650-49.2TMX	PAT650-61.5TMX
850 V	PAT850-18.8TM			
	PAT850-18.8TMX			

* How to read model names: The value before the hyphen is the rated voltage; the value after the hyphen is the rated current. An "X" at the end of the model name indicates that a breaker is included. (Example: PAT20-2000TM indicates a model for 0 to 20 V and 0 to 2000 A.)

Compact DC Power Supply(CV/CC)

PMX-A Series

LAN USB GPIB (OPTION) RS232C DRIVERS CE LXI

*Refer to page 8

A standard feature of the networking capability provides extended applications of the ordinary testing.

The PMX-A series is a compact, high-performance DC power supply that provides constant voltage (CV) and constant current (CC). It is designed to improve working efficiency for benchtop uses. For this purpose, the output terminals are located on the front panel and are ergonomically designed so that wiring harnesses for electrical loads can be connected by moving your fingers naturally. Moreover, a forced air cooling system is used to intake and exhaust of the internal air, so the unit can be rack mounted without space. Furthermore, the PMX-A is equipped with LAN, USB, and RS232C interfaces as standard interfaces required for system operation. In particular, the LAN interface enables you to control and monitor the power supply from Web browsers on PCs, smartphones, tablets, and other terminal devices. Moreover, the PMX-A is LXI(LAN eXtention for Instrumentation) compliant instrument, so it can be connected easier with your measurement system using LAN interface. The PMX-A is also equipped with remote sensing (for 18V, 35V models only), analog external control/monitoring output, various protective functions, memory function, and other functions.

Dimensions

107(4.21″)W × 124(4.88″)H × 315(12.40″)Dmm(inch)

Accessories

Power cord (Approximately 2.5 m), Packing list, Quick reference (Japanese/English/Chinese), Safety precautions, CD-ROM

Options

■ Connector kit
OP01-PMX
■ Terminal unit(for use with the PMC-A series)
TU01-PMX
■ Sequence creation software
SD025-PMX (Wavy for PMX)

Features

- Series regulator system with excellent noise performance
- High setting resolution - Voltage: 1 mV, Current: 0.1 mA (PMX18-2A)
- Wide range of output variations (9 models are available)
- LAN (LXI compliant) / USB / RS232C as standard interface
- External analog remote control
- Monitoring and status signal output
- CV, CC priority start function (to prevent overshoot when the output is ON)
- Remote sensing function (18V, 35V models)
- Key lock, 3-point preset memory function

Specifications

Model	Output		Ripple		Line Regulation		Load Regulation		Input (AC)		Weight
	CV	CC	CV	CC	CV	CC	CV	CC	Voltage	Power	Approx.
	V	A	mVrms	mArms	mV	mA	mV	mA	V±10%	Approx.VA	kg / lbs
PMX18-2A	0 to 18	0 to 2	0.5	1	± 1	± 5	± 2	± 5	100	150	5
PMX18-5A	0 to 18	0 to 5	0.5	2	± 1	± 5	± 5	± 5	100	310	6
PMX35-1A	0 to 35	0 to 1	0.5	1	± 3	± 5	± 3	± 5	100	150	5
PMX35-3A	0 to 35	0 to 3	0.5	1	± 3	± 5	± 4	± 5	100	310	6
PMX70-1A	0 to 70	0 to 1	1	1	± 5	± 2	± 5	± 5	100	230	6
PMX110-0.6A	0 to 110	0 to 0.6	2	1	± 7	± 2	± 7	± 5	100	210	6
PMX250-0.25A	0 to 250	0 to 0.25	3	1	± 15	± 1	± 15	± 5	100	210	6
PMX350-0.2A	0 to 350	0 to 0.2	5	1	± 25	± 1	± 25	± 5	100	230	6
PMX500-0.1A	0 to 500	0 to 0.1	10	1	± 30	± 1	± 30	± 3	100	170	6

■ Easy access with the built-in web server

Use a browser from a PC, smartphone, or tablet to access the web server built into the PMX-A series for convenient control and monitoring.

[Recommended browser]
- Requires for the Internet Explorer version 9.0 or later
- Requires for the firefox 8.0 or later
- Requires for the safari / mobile Safari 5.1 or later
- Requires for the Chrome 15.0 or later
- Requires for the Opera 11.0 or later

* Connecting with a smartphone, tablet, etc. requires a Wi-Fi environment (wireless LAN router etc.).

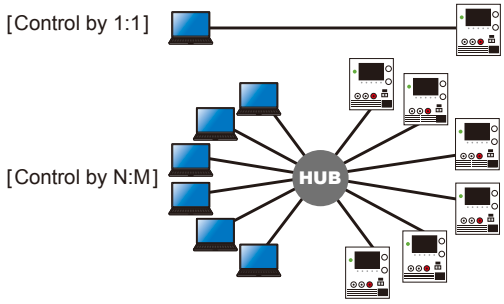
■ Digital, analog and other various external controls are supported. Remote control and monitoring can also be performed from Web browsers!

The PMX-A series is equipped with LAN, USB, and RS232C interfaces as standard communication interfaces. These interfaces enable remote control and monitoring to be performed efficiently in 1-to-N node configurations as well as in N-to-M node configurations even under large-scale networks. In particular, the LAN interface enables you to control and monitor the power supply through a browser on the PC, smartphone, tablet, or other terminal devices by accessing the built-in Web server of the PMX-A series.

■ LAN Interface

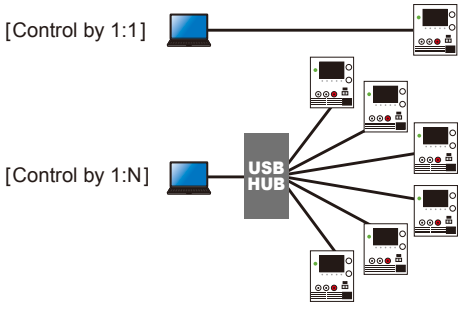
The LAN interface can control the number of devices with high speed, and it's theoretical controllable maximum number is to be calculated by approximately 4.2 billion. (The maximum transmission speed varies by the number of connected devices) In accordance with its applied standard, it is possible to combine the device that is to control or to be controlled, it is also the feature that it can be used with various applications. Also, in computers installed with Apple Bonjour, it is possible to access with a host name instead of the IP address.

● **AUTO MDIX function:** The PMX-A series can automatically identify the type of LAN cable whether straight or cross is connected and it connects using the appropriate method.



■ USB Interface

The USB interface has a feature of high versatility, and the ease of a setup. The automatic recognition by the plug and play releases a user from the complex setting operation under the digital control, and it can be suitable interface when control by 1:1. In accordance with the standard, the maximum number of the connected devices can be configured up to 127 units. Moreover, the USB interface of the PWX series complies to USB2.0, and it has realized transmission speed of a maximum of 12 Mbps (es) (Full Speed).



Limited function edition *

Free downloads of "Wavy" sequence creation software

The limited function of the optional sequence creation and control software "SD025-PMX (Wavy for PMX)" is available to be downloaded free of charge. For details, please refer to the following information and our WEB.

* The number of steps is limited up to 5 steps.

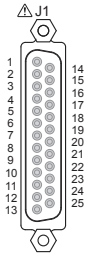
■ RS232C Interface

It can be used for communication with PCs and sequencers.

■ Analog Interface

The PMX-A series is equipped with external voltage/resistance control, which are interfaces required for analog external control and monitoring applications for test power supply devices. The input external signal and the output status signal can be conducted through the J1 connector on the rear panel.

J1 connector pin arrangement



Pin number positions when you are facing the rear panel

Pin No.	Signal name	Description
1	VMON	Output voltage monitor; outputs 0 V to 10 V for 0 % to 100 % of the rated output voltage.
2	IMON	Output current monitor; outputs 0 V to 10 V for 0 % to 100 % of the rated output current.
3	ACOM	External signal common for pins 1, 2, 4, and 14. *1
4	EXT-V CV CONT	Output voltage control using external voltage; receives 0 V to 10 V to output 0 % to 100 % of the rated voltage.
5	ACOM	External signal common for pins 1, 2, 4, and 14. *1
6	EXT-R CV CONT	Output voltage control using external resistance; uses 0 Ω to 10 kΩ to output 0 % to 100 % of the rated voltage.
7	EXT-R CV CONT COM	Common for output voltage control using external resistance.
8	N.C.	Not connected.
9	N.C.	Not connected.
10	N.C.	Not connected.
11	CV STATUS	On when the PMX series is in CV mode (open-collector output from a photocoupler).*2
12	CC STATUS	On when the PMX series is in CC mode (open-collector output from a photocoupler).*2
13	ALM STATUS	On when a protection function (OVP, OCP, or OHP) is activated (open-collector output from a photocoupler).*2
14	EXT-V CC CONT	Output current control using external voltage; receives 0 V to 10 V to output 0 % to 100 % of the rated current.
15	ACOM	External signal common for pins 1, 2, 4, and 14.1*1
16	EXT-R CC CONT	Output current control using external resistance; uses 0 Ω to 10 kΩto output 0 % to 100 % of therated current.
17	EXT-R CC CONT COM	Common for output current control using external resistance.
18	OUT ON/OFF CONT	Output on/off control using external contact input.
19	DCOM	External signal common for pin 18.*1
20	N.C.	Not connected.
21	N.C.	Not connected.
22	N.C.	Not connected.
23	OUT ON STATUS	On when output is on (output through an open-collector photocoupler).*2
24	PWR ON STATUS	On when the power is on (output through an open-collector photocoupler).*2
25	STATUS COM	Status signal common for pins 11, 12, 13, 23, and 24.

*1. During remote sensing, this is the negative electrode (-S) of sensing input. When remote sensing is not being performed, this isconnected to the negative output.
*2. Open collector output: maximum voltage 30 V, maximum current (sink) 8 mA; the status common is floating (isolation voltage or less), it is isolated from the control circuit.

Compact Multi-Output DC Power Supply (CV/CC)

PMX-Multi Series

LAN USB RS232C LXI CE

*Refer to page 8

*Applied to models with input voltage 234 V only.

Three models with 2, 3 and 4 outputs. Optimal for R&D as well as manufacturing lines.

The PMX-Multi series is a multi-channel DC power supply with isolated outputs on each channel. The PMX32-3DU (2ch), PMX32-3TR (3ch), and PMX32-2QU (4ch) are all capable of simultaneous output in all channels and come with an output tracking feature. Also, channels 1 & 2 of each model can be easily connected in either series or parallel to increase the output voltage/current at the press of a button. LAN (LXI Compliant), USB, and RS232C are included as standard digital interfaces for easy system integration. The PMX-Multi benefits from a low noise, series regulator design that makes this series the perfect choice for experiments involving transistors, IC circuits, and op amp circuits as well as R&D and production line applications.

Dimensions / Weight

214(8.46″)W×124(4.88″)H×400(15.75″)Dmm(inch) / 13kg(28.66 lbs.)

Accessories

Power cord: 1 pc. Output terminal cover set: 1 set. Packing list: 1 copy. Safety Information: 1 copy. CD-ROM: 1 disc.

Application

- Power supply for tests involving transistors, IC circuits and operational amplifiers
- Integration into semiconductor evaluation test systems
- Power supply for research and development and manufacturing line integration

Features

- Each output is isolated
- High setting resolution (Voltage: 1 mV, Current: 0.1 mA)
- Tracking control in all channels
- Simultaneous display of all channel statuses
- ON/OFF delay of each output
- Simple series/parallel connection between channels (CH1 & CH2)
- LAN (LXI Compliant)/USB/RS232C standard interface
- Turning output on and off using an external contact
- Remote sensing function
- Key lock, Preset memory function (3 slots)
- High quality LCD panel for improved visibility

Specifications

Model	Output			Ripple		Line Regulation		Load Regulation		Input (AC)		Weight
	CH	CV	CC	CV	CC	CV	CC	CV	CC	Voltage	Power	Approx.
		V	A	μV	mA	mV	mA	mV	mA	V±10%	Approx.VA	kg / lbs
PMX32-3DU	1	32.000	3.000	500	1	3	0.01% +0.25	4	5	217 (100, 117, 200, and 234 are factory options)	700	13/28.66
	2	32.000	3.000		1	3		4				
PMX32-3TR	1	32.000	3.000		1	3		4			900	
	2	32.000	3.000		1	3		4				
	3	6.000	5.000		2	1		5				
PMX32-2QU	1	32.000	2.000		1	3		2			800	
	2	32.000	2.000		1	3		2				
	3	18.000	2.500		1	1		3				
	4	18.000	2.500		1	1		3				

Easy access with the built-in web server

Use a browser from a PC, smartphone, or tablet to access the web server built into the PMX-Multi series for convenient control and monitoring.

[Recommended browser]
- Requires for the Internet Explorer version 9.0 or later
- Requires for the firefox 8.0 or later
- Requires for the safari / mobile Safari 5.1 or later
- Requires for the Chrome 15.0 or later
- Requires for the Opera 11.0 or later

* Connecting with a smartphone, tablet, etc. requires a Wi-Fi environment (wireless LAN router etc.).

Functions

■ Tracking feature

The tracking feature allows the operator to control the ratio for increase/decrease of output among multiple channels within the power rating. This feature can be used freely among all channels with two ratio options: absolute value variation and variation ratio.

Absolute value variation

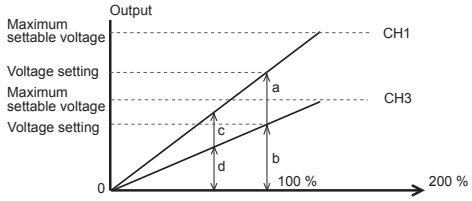
This mode allows for voltage/current settings in all specified channels to change at the same rate as a selected channel.

Variation ratio

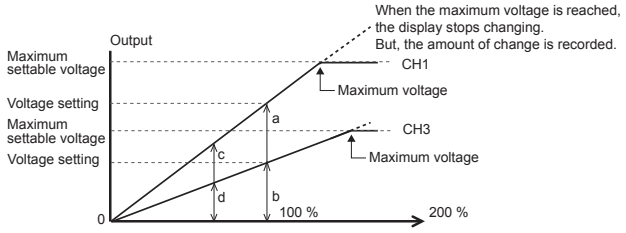
This mode allows for voltage/current settings in all specified channels to change in equal proportion to a selected voltage or current rating.
*The variable range is from 0.0% to 200.0%

Example: Here we will use TRACKING 2 on CH1 and CH2 of a PMX32-2QU.
When you turn the rotary knob during tracking operation, the outputs change at the same percentage as the preset output percentage (b/a).
b/a = d/c
This proportional expression is satisfied.

Example when the voltage is changed within the rated output

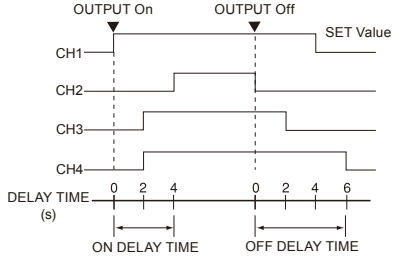


Example when the voltage is changed above the maximum settable output



■ Delay function

The optional setting creates a programmable delay between the OUTPUT switch being activated and the actual output being released. The setting range for DELAY TIME is from 0.1 - 99.9 seconds.



Item	ON DELAY SET value	OFF DELAY SET value
CH1	0 s	4 s
CH2	4 s	0 s
CH3	2 s	2 s
CH4	2 s	6 s

Timing chart of delay function

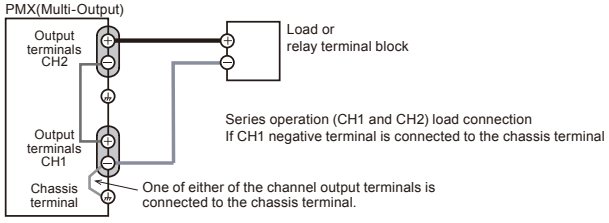
Note: The actual rise/fall time with output off will vary depending on the output and load conditions. Note that the timing chart above ignores rise and fall time. There are cases where the actual delay time varies by a few tens of milliseconds even when the delay time is set to 0 seconds.

When power supplies are not activated properly, there is the slight risk of damage being caused to the overall system. For this reason ON delay control is a very important feature that is required for power source output. This feature is also necessary when turning output OFF, and is highly convenient for operating circuits.

■ Simple series/parallel connection between channels

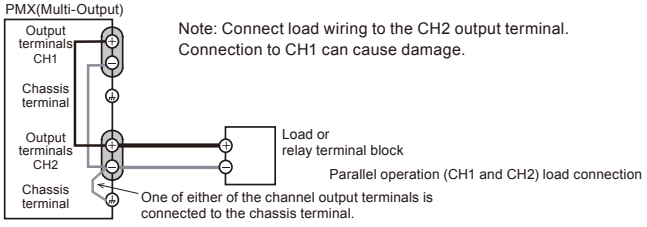
Series operation

CH1 and CH2 can be connected in series to increase the overall voltage output range. CH2 operates as master and CH1 as slave. The total output voltage will be the sum of CH1 and CH2.



Parallel operation

CH1 and CH2 can beconnected in parallel to increase the overall current range. CH2 operates as master and CH1 as slave.
The total output current will be the sum of CH1 and CH2.



Multi Channel Tracking DC Power Supply (CV/CC) * While Supplies Last

PMP Series

USB OPTION GPIB OPTION RS232C OPTION DRIVERS

PMP16-1QU PMP25-2TR PMP18-3TR

*Multi-output power supply characterized by multi-channel tracking and positive polarity**

The small-size PMP Series is a DC power supply that supports simple functions and provides constant multi-output voltage (CV) and current (CC). The past multi-output power supply can provide only two types of concurrently variable output. The PMP Series, however, implements "Multi-channel Tracking" that allows all types of output to be varied concurrently. It also supports a "Delay Function" that can change output on/off timing, and a "Memory Function" that can store output settings. Moreover, the PMP Series is equipped with an external contact that enables control over turning on and off output, and over calling the memory. All the types of output this product provides have positive polarity*, which allows the product to be used as a power supply for developing digital equipment and other devices not requiring a negative power supply circuit. Furthermore, this product, which supports two common systems, is well adapted to an application for one power supply unit to offer digital and analog signals that have different common potentials.

Dimensions / Weight

142.5(5.61″)W × 124(4.88″)H × 400(15.75″)Dmm(inch) / 9kg(19.84 lbs)

Accessories

Operation manual, Input power cord, Binding post covers, Output terminal shorting bar

Options

■ Interface board
GPIB Interface factory option
USB Interface factory option
RS232C interface factory option
Note: Only one interface board can be installed.

Features

- ■ All the types of output have positive polarity*, and the output capacity (current rating) is enhanced
- ■ The supported multi-channel tracking function allows all output to be varied concurrently in the same ratio or width (absolute value)
- ■ The available delay function has the ability to change timing at which to turn on or off the output
- ■ The supported memory function has the capability to store output settings (This product has three memories.)
- ■ Voltage and current can be displayed under high resolution of four digits
- ■ Two common systems are available
  (The three-output model supports CH1 and CH2/CH3 common, while the four-output model supports CH1/CH2 common and CH3/CH4 common.)
- ■ A remote sensing function is supported for all output
- ■ Control via an external contact (Memories 1, 2 and 3, as well as output on/off)
- ■ The communications interface (GPIB, RS232C or USB) can be equipped as a factory option

* Only three-output model

Specifications

Model		Output		Ripple		Line Regulation		Load Regulation		Power Source	Power Consumption	Weight
		CV	CC	CV	CC	CV	CC	CV	CC	AC	Approx.	
		V	A	mV rms	mA rms	mV	mA	mV	mA	V	VA	kg/lb
PMP18-3TR	OUTPUT CH1	0 to +6	0 to +5	0.5	4	±2	±4	±5	±10	100 (120/220 to 250: optional)	400	9/19.84
	OUTPUT CH2	0 to +18	0 to +3		3	±1	±3	±3	±5			
	OUTPUT CH3	0 to +18	0 to +3		3	±1	±3	±3	±5			
PMP25-2TR	OUTPUT CH1	0 to +6	0 to +5		4	±2	±4	±5	±10		380	
	OUTPUT CH2	0 to +25	0 to +2		3	±2	±2	±3	±5			
	OUTPUT CH3	0 to +25	0 to +2		3	±2	±2	±3	±5			
PMP16-1QU	OUTPUT CH1	0 to +25	0 to +3		3	±2	±4	±5	±10		370	
	OUTPUT CH2	0 to +6	0 to +2		3	±2	±3	±3	±10			
	OUTPUT CH3	0 to -16	0 to -1		2	±1	±2	±3	±5			
	OUTPUT CH4	0 to +16	0 to +1		2	±1	±2	±3	±5			

High Reliability DC Power Supply (CV/CC)

PAN-A Series

GPIB OPTION RS232C OPTION

Basic DC power supplies superior for general purpose use...

The PAN-A Series is a high-performance, highly reliable DC power supply unit featuring regulated variable voltage. These units are suitable for use in a range of fields including research and development, quality control, and production. The PAN-A Series consists of a pre-regulator using FETs and a series regulator using power transistors, providing the high-quality output characteristic of the latter as well as the low power-source harmonic distortion of choke input type phase control. To achieve the high reliability and safety, components of sufficient derating and long-proven mounting techniques are used throughout. All models are carefully designed and furnished with over voltage protection (OVP) and various safety functions.

Dimensions

Type 0 : 106(4.17″)W × 140(5.51″)H × 400(15.75″)Dmm(inch)
Type I 2: 210(8.27″)W × 140(5.51″)H × 350(13.78″)Dmm(inch)
Type I 3: 210(8.27″)W × 140(5.51″)H × 400(15.75″)Dmm(inch)
Type II : 430(16.93″)W × 160(6.3″)H × 400(15.75″)Dmm(inch)

Features

- Low temperature drift
- Quick transient response
- Low ripple noise voltage
- Various safety functions
- External analog control
- GPIB control (optional function)

Specifications

Model	Output		Ripple		Line Regulation		Load Regulation		Dimensions	Weight	Input	
	CV	CC	CV	CC	CV	CC	CV	CC	Type	kg/lb	Voltage(AC)	Power consumption
	V	A	mV rms	mA rms	0.005 %+mV	mA	0.005 %+mV	mA			V	Approx. kVA
PAN 16-10A	0 to 16	0 to 10	0.5	2	1	1	1	3	0	11/24.25	100	0.4
PAN 16-18A		0 to 18	0.5	5	1	1	1	3	I2	17/37.48	100	0.8
PAN 16-30A		0 to 30	0.5	5	1	3	2	3	I3	23/50.71	100	1.1
PAN 16-50A		0 to 50	0.5	10	1	3	2	5	II	36/79.37	100	1.6
PAN 35-5A	0 to 35	0 to 5	0.5	1	1	1	1	2	0	11/24.25	100	0.4
PAN 35-10A		0 to 10	0.5	2	1	1	1	3	I2	17/37.48	100	0.8
PAN 35-20A		0 to 20	0.5	3	1	3	2	3	I3	23/50.71	100	1.4
PAN 35-30A		0 to 30	0.5	5	1	3	1	5	II	36/79.37	100	1.8
PAN 60-3A	0 to 60	0 to 3	0.5	1	1	1	1	2	0	11/24.25	100	0.35
PAN 60-6A		0 to 6	0.5	2	1	1	1	3	I2	17/37.48	100	0.7
PAN 60-10A		0 to 10	0.5	3	1	3	2	3	I3	22/48.5	100	1.1
PAN 60-20A		0 to 20	0.5	2	1	1	1	2	II	35/77.16	100	2.1
PAN 70-2.5A	0 to 70	0 to 2.5	0.5	1	1	1	1	1	0	11/24.25	100	0.35
PAN 70-5A		0 to 5	0.5	2	1	1	1	2	I2	17/37.48	100	0.8
PAN 70-8A		0 to 8	1	2	1	1	1	3	I3	22/48.5	100	1.1
PAN 70-15A		0 to 15	1	5	1	1	1	3	II	35/77.16	100	1.9
PAN 110-1.5A	0 to 110	0 to 1.5	0.5	1	1	1	1	1	0	11/24.25	100	0.4
PAN 110-3A		0 to 3	0.5	1	1	1	1	2	I2	17/37.48	100	0.7
PAN 110-5A		0 to 5	1	1	1	1	1	2	I3	22/48.5	100	1.0
PAN 110-10A		0 to 10	1	2	1	1	1	3	II	35/77.16	100	2.0
PAN 160-1A	0 to 160	0 to 1	1	1	1	1	1	1	0	11/24.25	100	0.33
PAN 160-2A		0 to 2	1	1	1	1	1	2	I2	17/37.48	100	0.7
PAN 160-3.5A		0 to 3.5	1	1	1	1	2	2	I3	22/48.5	100	1.0
PAN 160-7A		0 to 7	1	2	1	1	2	2	II	36/79.37	100	1.9
PAN 250-2.5A	0 to 250	0 to 2.5	5	2	2	1	3	1	I3	23/50.71	100	1.1
PAN 250-4.5A		0 to 4.5	5	2	2	1	3	2	II	35/77.16	100	1.8
PAN 350-3.5A	0 to 350	0 to 3.5	1	2	1	1	1	2	II	36/79.37	100	2.1
PAN 600-2A	0 to 600	0 to 2	1	0.5	0.002 %+1	0.5	0.002 %+1	1	II	37/81.57	100	2.0

Input voltage: 110 VAC, 120 VAC, 200 VAC, 220 VAC, 230 VAC and 240 VAC input are available at request.

Variable Regulated DC Power Supply (CV/CC)

PAD-LA Series

GPIB OPTION RS232C OPTION

TYPE III

TYPE IV

Linear DC power supply series built with its reliability from our steadfast history

The PAD-LA Series is renewal version of our long seller models "PAD-L Series" as known for high performance and high reliability of variable DC regulated power supplies used with excellent regulators. The PAD-LA Series has polished features and performance also it has improved the "easy to use" operation by adopting an advanced design and we aim to establish the "New Basic Power Supply" which can be used in all fields of application from the R&D, Quality Control to the Manufacturing site.

Dimensions

Type III: 430(16.93″)W × 218(8.58″)H × 549(21.61″)Dmm(inch)
Type IV: 430(16.93″)W × 484.6(19.08″)H × 465(18.31″)Dmm(inch)

Accessories

Operation Manual, Guard caps, Weight sticker
Type III: Power cord (3-core cabtire cable for 200 VAC, 3.5 mm^2, approx. 3 m)
Type IV: Power cord (Single wire cable, 8 mm^2, approx. 3 m), Cable clamper

Features

- Use large LED monitor with high visibility for 4 digits display
- Output and Set Switch
- Putting together of the mode setting switches
- OCP (Over Current Protection circuit)
- Output Monitoring
- Control Terminals

Functions

■ Use large LED monitor with high visibility for 4 digits display

Adopting with the Digital display from former Analog type, which display the output Voltage, and Current. Furthermore, by locating each indication of the CV/CC and ON/OFF operation around the display, it can easily confirm the required information immediately.

■ Output and Set Switch

In separate to the Power Switch of the unit, it has equipped the "Output Switch" and also the "SET Switch" which enable to confirm the setting value of voltage and current even when the output is off.

■ Putting together of the mode setting switches

Improving the convenience of operation, we have put together all of the switches located on the upper right area of the unit for the function of Output, Adjusting display, variable resistor for setting of OVP and OCP, Setting operation mode for Analog Remote control, one control parallel operation (or series operation) to set for Master or Slave unit.

■ OCP (Over Current Protection circuit)

In addition to OVP (Over Voltage Protection circuit) function, it is equipped with OCP (Over Current Protection circuit) as standard.

■ Output Monitoring

It is equipped with the Monitor Output Terminal for Output Voltage and Output Current as standard. The Monitor Output for Output Voltage is 0 to approx. 10 V at 0 to the rated output voltage, and for the Output Current is 0 V to approx. 1 V at 0 to the rated output current.

■ Control Terminals

Adopting the screw less wire clamp for the control terminal block on the rear panel that was used to be the harmonica terminal.

Specifications

Model	Output		Ripple		Line Regulation		Load Regulation		Dimensions	Weight	Input	
	CV	CC	CV	CC	CV	CC	CV	CC	Type	kg/lb	Voltage(AC)	Power
	V	A	mV rms	mA rms	0.005 %+mV	mA	0.005 %+mV	mA			V±10 %	kVA
PAD16-100LA	0 to 16	0 to 100	0.5	100	1	3	2	5	III	65/143.3	200	3.3
PAD36-60LA	0 to 36	0 to 60	0.5	10	1	3	2	5	III	66/145.5	200	3.8
PAD36-100LA	0 to 36	0 to 100	0.5	50	1	3	2	5	IV	96/211.6	200	7.1
PAD60-35LA	0 to 60	0 to 35	0.5	8	1	3	2	3	III	64/141.1	200	3.4
PAD60-60LA	0 to 60	0 to 60	0.5	20	1	3	2	5	IV	96/211.6	200	6.9
PAD72-30LA	0 to 72	0 to 30	0.5	6	1	3	2	3	III	64/141.1	200	3.8
PAD110-20LA	0 to 110	0 to 20	1	4	1	1	2	3	III	63/138.9	200	3.8
PAD110-32LA	0 to 110	0 to 32	1	10	1	3	2	5	IV	94/207.2	200	6.7
PAD250-8LA	0 to 250	0 to 8	5	4	2	1	3	3	III	63/138.9	200	3.4
PAD250-15LA	0 to 250	0 to 15	5	5	2	1	3	3	IV	92/202.8	200	6.7

Programmable Bipolar Power Supply (CV/CC)

PBZ Series

LAN OPTION USB GPIB RS232C DRIVERS CE

LXI

*Refer to page 8

Superior output characteristic by adopting the power amp system

The PBZ series is a bipolar type DC regulated power source that can continuously change both positive and negative polarities passing through 0 without changing the output terminal.
By adopting a "Switching + Linear" system, the PBZ is able to realize 40 % lighter than PBX series while achieving high speed operation with low ripple noise. Since operation covers 4 quadrants, power can be both supplied (source) and absorbed (sink). The PBZ can also drive inductive or capacitive loads. The unit also equips a signal generator function which enables waveform and sequence creation. The PBZ is also capable of synchronized operation which is required for voltage variation tests, and it can also be expanded for large current applications through master-slave parallel operation.

Dimensions / Weight

429.5(16.91″)W × 128(5.0″)H × 550(21.65″)Dmm (inch)/ 22kg(48.5lbs)

Accessories

Operation manual, Power cord, Cord set, Weight sticker

Features

- Waveform generation function
- Low ripple noise
- Synchronized operation function(Trigger-based, Clock-based)
- Sequence function
- Unipolar mode
- Parallel operation function
  (Applied to the same model for 2 units, the PBZ-SR Series for 3 to 5 units in parallel connection)
- High-speed response 100 kHz (CV)

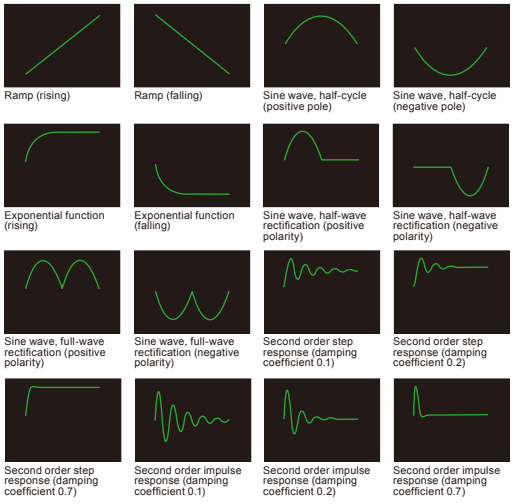
Functions

■ Waveform generation function

In addition to the basic sine, square and triangular waveforms, the PBZ series is equipped with a user-defined waveform generating function that can register up to 16 waveforms. It allows the amplitude, frequency, start phase, frequency sweep and square wave duty to be set as needed.
The 16 user-defined waveforms can be freely edited, and the original created and edited waveforms can be registered and easily recalled for use. The sequence function allows each waveform to be set as a single step, and a maximum of 1024 steps can be set in the 16 programs.

● 3 basic waveforms

● 16 user-defined waveforms (The waveforms below are registered as defaults.)



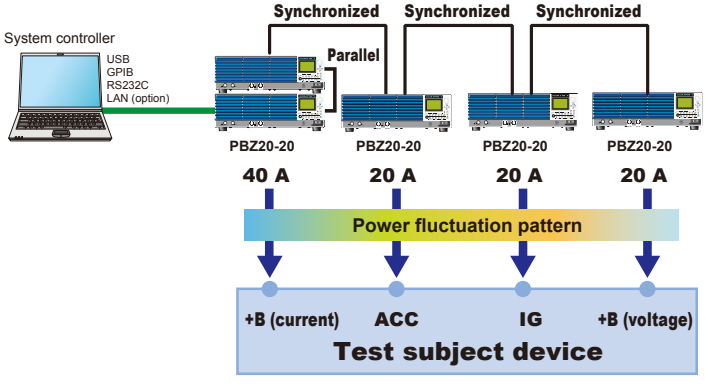
■ Low ripple and noise (in CV mode)

For the Ripple 2 mVrms, Noise 20 mVp-p (PBZ20-20)
4 mVrms, Noise 20 mVp-p (PBZ40-10)
4 mVrms, Noise 30 mVp-p (PBZ60-6.7)
4 mVrms, Noise 30 mVp-p (PBZ80-5)

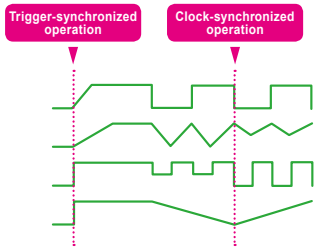
■ Synchronized operation function (Trigger synchronized, Clock synchronization)

This function synchronizes the power output when a sequence is executed using multiple PBZ. It prevents time deviations from occurring even when a long sequence is executed. *A delay of up to 1 µs occurs at the start.

● Sample configuration of a voltage fluctuation test system



● Example of combined trigger- and clock-synchronized operation



Functions

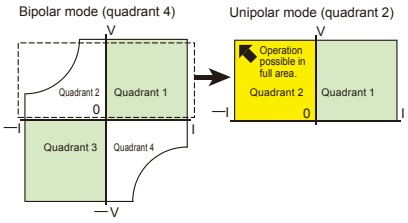
■ Sequence function

The basic sine, triangular and square waveforms, as well as the 16 user-defined waveforms, can each be set as a sequence step, allowing even complex sequences to be created easily. Sequences are composed of up to 1024 steps. This combination of steps forms a program, and the 1024 steps can be allocated and set in a maximum of 16 programs. When executing sequences, in addition to executing a single program, the script function also allows multiple programs to be combined and executed as needed.

A script is a function that specifies the sequence and number of repetitions for the set programs. A maximum of 50 lines can be set in 1 script for each CV and CC mode.

■ Unipolar mode

This is a function unique to this product. Because the voltage is unipolar, this function is called “unipolar mode”. With unipolar power, although the current flows in a single direction, in unipolar mode it is still possible to apply current in both directions (source and sink). As shown in the diagram, on a graph with perpendicular axes of voltage (vertical) and current (horizontal), operation is possible in quadrant 1 and quadrant 2 (2 quadrants). In bipolar mode, there are power restriction areas (PBZ20-20: 100 W, PBZ40-10: 180 W, PBZ60-6.7/PBZ80-5: 200 W) in quadrants 2 and 4. However in unipolar mode, operation is possible in the full area of quadrant 2.



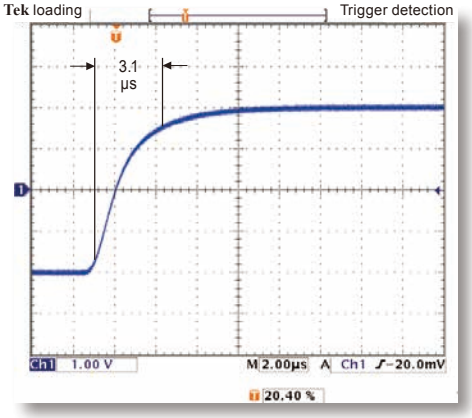
■ Parallel operation function

This function expands the output current. It allows multiple units to be connected in parallel according to the required current. With 2 units of the same model and the optional parallel operation kit, the user can easily complete the setup. Although up to 5 units can be operated in parallel, if 3 or more units will be used, please consult with us.

■ High-speed response

100 kHz frequency characteristic (CV)

The superior waveform quality with rise and fall with times of 3.5 µs which makes it possible to reproduce a variety of waveforms with high precision.



▲ Sample of rising waveform when response of 3.5 µs is set

Options

■ Vertical stand

VS01

■ Parallel operation kit

PK01-PBZ
PK02-PBZ(EIA)
PK03-PBZ(JIS)

■ Sequence Creation Software

Wavy for PBZ

■ Interface Board

RS232C Interface
GPIB Interface
USB Interface
LAN Interface factory option

It applies to control and monitor the power supply from a browser.

■ Smart rack system

Parallel operation of same-model units can be used for large currents.
The parallel operation kit can be used for 2 units.
For systems of 3 to 10 units, please consult with us.

*For the details, please refer to page 36, 37.

Specifications

Model	Output		Constant Voltage			Constant Current			Weight	Input	
	CV	CC	Ripple	Source Effect	Load Effect	Ripple	Source Effect	Load Effect		Voltage	Power
	V	A	rms/p-p	mV	mV	mA rms	mA	mA	kg/lb		
PBZ20-20	±20	±20	2 mV/20 mV(TYP)	±(0.005 % of setting + 1 mV)	±(0.005 % of setting + 1 mV)	3(TYP)	±(0.01 % of setting + 1 mA)	±(0.01 % of setting + 1 mA)	22/48.5	100 VAC to 240 VAC 50/60 Hz	900 VA or less (at rated load)
PBZ40-10	±40	±10	4 mV/20 mV(TYP)								
PBZ60-6.7	±60	±6.7	4 mV/30 mV(TYP)								
PBZ80-5	±80	±5									

Common Specifications

Rush Current ..... 13 A (for input power supply of AC 110 V)
Constant Voltage (CV) Mode
Setting resolution ..... (DC Voltage)0.001 V (0.0001 V for fine feature)(20 V, 40 V model)
0.002 V (0.0002 V for fine feature)(60 V, 80 V model)
(AC Voltage)0.01 V (20 V model), 0.1 V (40 V, 60 V, 80 V model)
Temperature Coefficient .. ±(100 ppm/°C of rating) (TYP value)
Response*2 *3 ..... 3.5 µs, 10 µs, 35 µs, 100 µs (TYP value)
Frequency characteristic*1 ... DC to 100 kHz (TYP value)
Constant Current (CC) Mode
Setting resolution ..... (DC Current)0.001 A(0.0001 A for fine feature)
(AC Current)0.01 A
Temperature Coefficient .. (DC Voltage)±(100 ppm/°C of rating) (TYP value)
Response*2 *5 ..... 35 µs, 100 µs, 350 µs, 1 ms (TYP value) [PBZ20-20/PBZ60-6.7/PBZ80-5]
70 µs, 100 µs, 350 µs, 1 ms (TYP value) [PBZ40-10]

Frequency characteristic*4 ... DC to 10 kHz (TYP value) [PBZ20-20/PBZ60-6.7/PBZ80-5]
DC to 5 kHz (TYP value) [PBZ40-10]
Protection functions ..... Overvoltage protection, Overcurrent protection, Overheating protection, Power restriction (Sink power)

*1: Frequency at which the amplitude ratio of the output voltage relative to the external signal input voltage is -3 dB (at standard frequency 1 kHz, response 3.5 µs, rated load)
*2: Rise time/fall time (at rated load, excepting output ON/OFF) Frequency characteristic determined by the set response (frequency band = 0.35/Rise time).
*3: Rise time: When the output voltage is changed from 0 V to the rated voltage, the rise time is the time during which output voltage changes from 10 % to 90 % of the rated voltage.
Fall time: When the output voltage is changed from the rated voltage to 0V, the fall time is the time during which output voltage changes from 90 % to 10 % of the rated voltage.
*4: Frequency at which the amplitude ratio of the output current relative to the external signal input voltage is -3 dB (at stanndard frequency 100 Hz, response 35/70 µs, rated load)
*5: Rise time: When the output voltage is changed from 0 V to the rated current the rise time is the time during which output current changes from 10 % to 90 % of the rated current.
Fall time: When the output current is changed from the rated current to 0 V, the fall time is the time during which output current changes from 90 % to 10% of the rated current.

Inteligent Bipolar Power Supply (CV/CC)

PBZ20-20A

LAN OPTION LXI | USB | GPIB | RS232C | DRIVERS | CE

*Refer to page 8

Ideal for voltage variation testing of automotive electrical components, high power capacitor voltage fluctuation tests and motor evaluation tests!

The PBZ20-20A Intelligent Bipolar Power Supply takes a fresh new look at bipolar power supply design, allowing for peak current up to 6 times that of the rated output. As a result, peak currents exceeding the 20A rating can be easily compensated with a single unit, eliminating the need to connect multiple units in parallel, and greatly cutting costs.

Dimensions / Weight

429.5(16.91″)W × 128(5.0″)H × 550(21.65″)Dmm (inch)/ 22kg(48.5lbs)

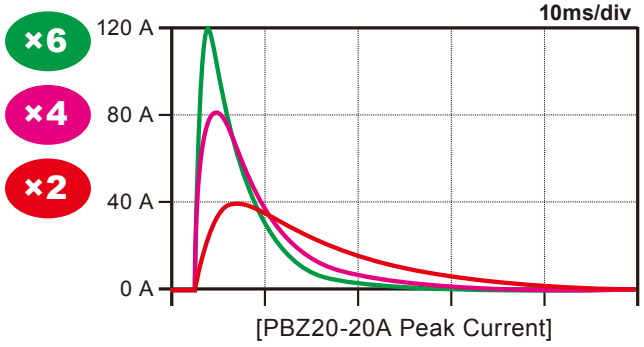
Accessories

Operation manual, Power cord, Cord set, Weight sticker

Features

- Peak Current 6x Rating (±120 Apk CV)
- Parallel Operation up to 10 Units (Max 1200 Apk)
  *Please consult if using 11 units or more.
- CV Frequency: 150 kHz DC
- Waveform generation function
- Sequence function
- Synchronized operation function(Trigger-based, Clock-based)
- Unipolar mode
- Low ripple noise(CV mode)

Functions



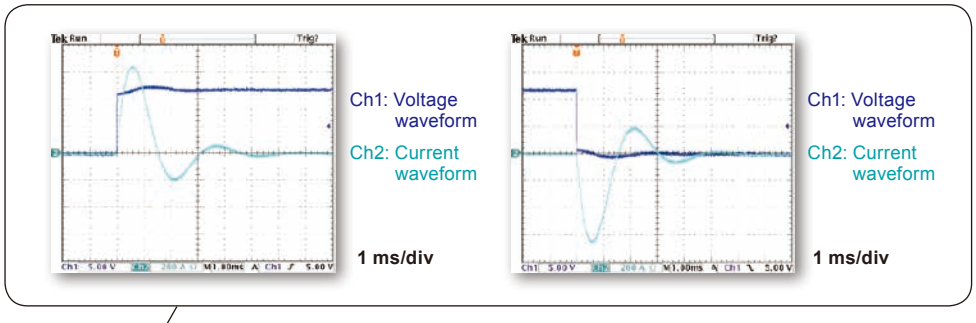
[PBZ20-20A Peak Current]

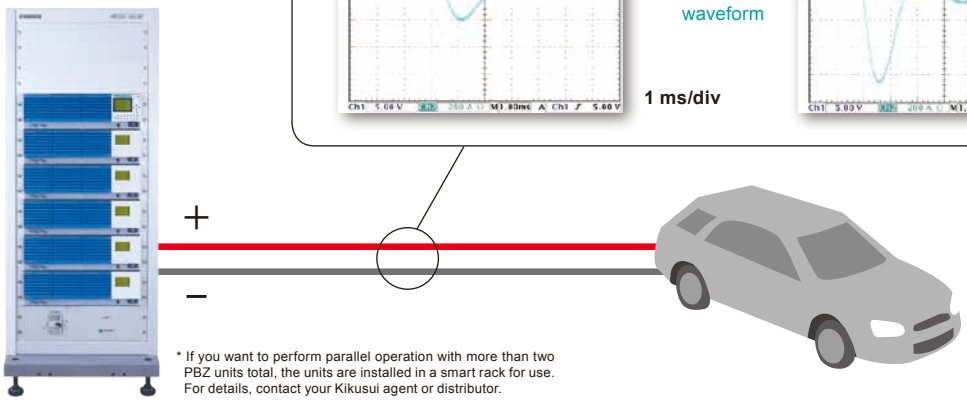
PBZ20-20A
Output Rating: 400 W, ±20 V, ±20 A

The car battery is the primary source of energy for modern-day vehicular components, but factors such as electronic circuit chatter as well as inrush caused by the engine can present various difficulties. Power source disturbances caused by these factors make programming and evaluating power supply fluctuation waveforms an absolute must. The PBZ20-20A Intelligent Bipolar Power Supply has the high speed response to meet the demands of voltage fluctuation tests (Pulse2b, Pulse4, etc.) for international standards such as the ISO16750-2 and ISO7637-2 as well as for the increasingly complicated fluctuation waveform tests requried by automotive manufacturers.
The PBZ20-20A is also equipped to easily comply with the steady increase of electronic components per vehicle (high power capacitors, etc.) and total current (esp. peak current) required in modern-day automotive testing.

■ Power variation test

PBZ20-20A 6 parallel
720 A peak compatible
Voltage rising edge/falling edge waveform
Ch1 5 V/div
Ch2 200 A/div





* If you want to perform parallel operation with more than two PBZ units total, the units are installed in a smart rack for use. For details, contact your Kikusui agent or distributor.

High Power Intelligent Bipolar Power Supply

PBZ SR Series

LAN USB GPIB RS232C DRIVERS CE LXI

*Refer to page 8

High-speed response with even higher power

The PBZ SR series is a series of high-power bipolar DC stabilized power supplies. Based on the PBZ Intelligent Bipolar power supply series, this model supports large currents (up to ±100 A) and is assembled with exclusive rack parts (Smart Rack). 4-quadrant operation allows power to be supplied (source) or absorbed (sink), making this series suitable for driving inductive loads or capacitive loads.
Also, LAN, USB, GPIB, and RS232C are provided (standard) as communication interfaces.

Dimensions / Weight

Three parallel: 432.6(17.03″)W × 579.4(22.81″)H × 700(27.56″)Dmm(inch)/ 110kg(242.5lbs)
Four parallel: 432.6(17.03″)W × 712.1(28.04″)H × 700(27.56″)Dmm(inch)/ 130kg(286.6lbs)
Five parallel: 432.6(17.03″)W × 844.8(33.26″)H × 700(27.56″)Dmm(inch)/ 160kg(352.7lbs)

Accessories

Setup Guide, Quick Reference(1 each for English and Japanese), Safety information (1 pc), CD-ROM (1 pc), J1 connector kit (1 set)

Features

- User-defined waveform generation function
- Sequence function
- Synchronized operation function
- Central control with master unit utilizing master and slave operation
- Master unit display of total output current of all units (display of combined value) *1
- Safety design that switches all units off when alarm is generated for 1 unit *2
- Guarantee of specifications with Smart Rack (test data standardly included)
- LAN (Capable of LXI), USB, GPIB, and RS232C provided (standard)
- 100 kHz frequency characteristic (CV)

*1 Slave unit displays its own output current.
*2 If the alarm for the master unit is cleared, alarms for all units are cleared.

● Three parallel type

Model	Output		Ripple • Noise		Line Regulation		Load Regulation		Input (AC)	
	CV	CC	CV	CC	CV	CC	CV	CC	nominal voltage	Current
	V	A	rms/p-p	rms	mV	mA	mV	mA	V	A
PBZ20-60 SR	±20	±60	3 mV/30 mV(TYP)	5 mA (TYP)	±0.005 %+1	±0.01 %+1	±0.005 %+1	±0.01 %+1	200 to 240, single phase	15 A (max)
PBZ40-30 SR	±40	±30	6 mV/30 mV(TYP)							
PBZ60-20.1 SR	±60	±20.1	6 mV/40 mV(TYP)							
PBZ80-15 SR	±80	±15								

● Four parallel type

Model	Output		Ripple • Noise		Line Regulation		Load Regulation		Input (AC)	
	CV	CC	CV	CC	CV	CC	CV	CC	nominal voltage	Current
	V	A	rms/p-p	rms	mV	mA	mV	mA	V	A
PBZ20-80 SR	±20	±80	3 mV/30 mV(TYP)	5 mA (TYP)	±0.005 %+1	±0.01 %+1	±0.005 %+1	±0.01 %+1	200 to 240, single phase	20 A (max)
PBZ40-40 SR	±40	±40	6 mV/30 mV(TYP)							
PBZ60-26.8 SR	±60	±26.8	6 mV/40 mV(TYP)							
PBZ80-20 SR	±80	±20								

● Five parallel type

Model	Output		Ripple • Noise		Line Regulation		Load Regulation		Input (AC)	
	CV	CC	CV	CC	CV	CC	CV	CC	nominal voltage	Current
	V	A	rms/p-p	rms	mV	mA	mV	mA	V	A
PBZ20-100 SR	±20	±100	3 mV/30 mV(TYP)	5 mA (TYP)	±0.005 %+1	±0.01 %+1	±0.005 %+1	±0.01 %+1	200 to 240, single phase	25 A (max)
PBZ40-50 SR	±40	±50	6 mV/30 mV(TYP)							
PBZ60-33.5 SR	±60	±33.5	6 mV/40 mV(TYP)							
PBZ80-25 SR	±80	±25								

High Power Intelligent Bipolar Power Supply

PBZ BP Series

LAN USB GPIB RS232C DRIVERS

LXI

High-speed response with even higher power

The PBZ BP series is a series of high-power bipolar DC stabilized power supplies. Based on the PBZ Intelligent Bipolar power supply series, this model supports large currents (up to ±200 A) and is assembled with rack system (bipolar pack). 4-quadrant operation allows power to be supplied (source) or absorbed (sink), making this series suitable for driving inductive loads or capacitive loads.
Also, LAN, USB, GPIB, and RS232C are provided (standard) as communication interfaces.

Features

- User-defined waveform generation function
- Sequence function
- Synchronized operation function
- Central control with master unit utilizing master and slave operation
- Master unit display of total output current of all units (display of combined value) *1
- Safety design that switches all units off when alarm is generated for 1 unit *2
- Guarantee of specifications with Smart Rack (test data standardly included)
- LAN (Capable of LXI), USB, GPIB, and RS232C provided (standard)
- 80 kHz frequency characteristic (CV)

*1 Slave unit displays its own output current.
*2 If the alarm for the master unit is cleared, alarms for all units are cleared.

Dimensions / Weight

Six parallel: 570(22.44″)W × 1350(53.15″)H × 950(37.40″)Dmm(inch)
Seven parallel: 570(22.44″)W × 1350(53.15″)H × 950(37.40″)Dmm(inch)
Eight parallel: 570(22.44″)W × 1350(53.15″)H × 950(37.40″)Dmm(inch)
Nine parallel: 570(22.44″)W × 1750(68.90″)H × 950(37.40″)Dmm(inch)
Ten parallel: 570(22.44″)W × 1750(68.90″)H × 950(37.40″)Dmm(inch)

Accessories

Setup Guide, Quick Reference(1 each for English and Japanese), Safety information (1 pc), CD-ROM (1 pc), J1 connector kit (1 set)

Options

■ AC power cord
AC14-3P3M-M5C

●Six parallel type

Model	Output		Ripple • Noise		Line Regulation		Load Regulation		Input (AC)		Weight
	CV	CC	CV	CC	CV	CC	CV	CC	nominal voltage	Current	kg/lb
	V	A	rms / p-p	rms	mV	mA	mV	mA	V	A	
PBZ20-120 BP	± 20	± 120	6 mV / 50 mV (TYP)	10 mA (TYP)	±0.005 %+1	±0.01 %+1	±0.005 %+1	±0.01 %+1	200 to 240, single phase	30 (max)	255/562.2
PBZ40-60 BP	± 40	± 60	12 mV / 50 mV (TYP)								

●Seven parallel type

Model	Output		Ripple • Noise		Line Regulation		Load Regulation		Input (AC)		Weight
	CV	CC	CV	CC	CV	CC	CV	CC	nominal voltage	Current	kg/lb
	V	A	rms / p-p	rms	mV	mA	mV	mA	V	A	
PBZ20-140 BP	± 20	± 140	6 mV / 50 mV (TYP)	10 mA (TYP)	±0.005 %+1	±0.01 %+1	±0.005 %+1	±0.01 %+1	200 to 240, single phase	35 (max)	280/617.3
PBZ40-70 BP	± 40	± 70	12 mV / 50 mV (TYP)								

●Eight parallel type

Model	Output		Ripple • Noise		Line Regulation		Load Regulation		Input (AC)		Weight
	CV	CC	CV	CC	CV	CC	CV	CC	nominal voltage	Current	kg/lb
	V	A	rms / p-p	rms	mV	mA	mV	mA	V	A	
PBZ20-160 BP	± 20	± 160	6 mV / 50 mV (TYP)	10 mA (TYP)	±0.005 %+1	±0.01 %+1	±0.005 %+1	±0.01 %+1	200 to 240, single phase	40 (max)	300/661.4
PBZ40-80 BP	± 40	± 80	12 mV / 50 mV (TYP)								

●Nine parallel type

Model	Output		Ripple • Noise		Line Regulation		Load Regulation		Input (AC)		Weight
	CV	CC	CV	CC	CV	CC	CV	CC	nominal voltage	Current	kg/lb
	V	A	rms / p-p	rms	mV	mA	mV	mA	V	A	
PBZ20-180 BP	± 20	± 180	6 mV / 50 mV (TYP)	10 mA (TYP)	±0.005 %+1	±0.01 %+1	±0.005 %+1	±0.01 %+1	200 to 240, single phase	45 (max)	340/749.6
PBZ40-90 BP	± 40	± 90	12 mV / 50 mV (TYP)								

●Ten parallel type

Model	Output		Ripple • Noise		Line Regulation		Load Regulation		Input (AC)		Weight
	CV	CC	CV	CC	CV	CC	CV	CC	nominal voltage	Current	kg/lb
	V	A	rms / p-p	rms	mV	mA	mV	mA	V	A	
PBZ20-200 BP	± 20	± 200	6 mV / 50 mV (TYP)	10 mA (TYP)	±0.005 %+1	±0.01 %+1	±0.005 %+1	±0.01 %+1	200, single phase	50 (max)	360/793.7
PBZ40-100 BP	± 40	± 100	12 mV / 50 mV (TYP)								

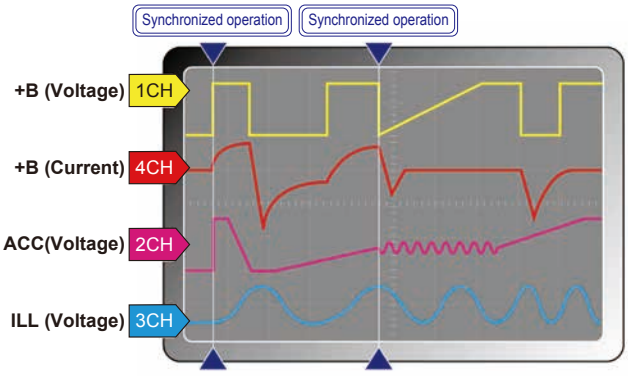
● Power Fluctuation Test Systems for Electrical Automotive Components

[Example of multichannel power fluctuation test]

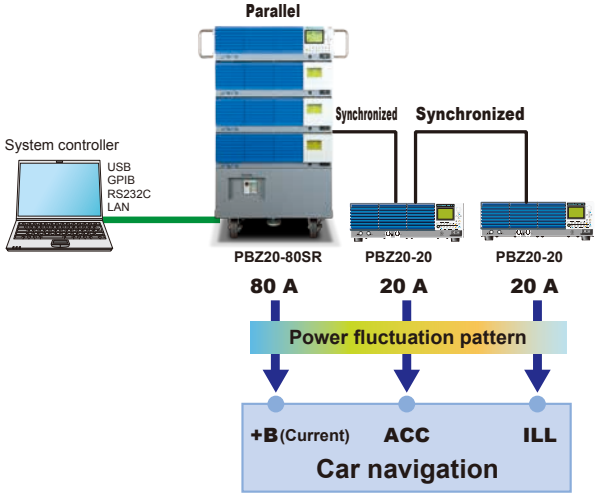
With automobiles, electricity is supplied from a battery. Multiple automotive electronic components either switch ON or OFF depending on the order in which the electricity is turned ON = order in which the key is turned (+B → ACC → IG). There are an extremely large number of unstable elements in an automobile's power supply environment, including engine start-up and electrical circuit chattering; thus, envisioning power supply problems caused by these elements, such as instantaneous power interruptions and fluctuations, a power fluctuation test is performed for the channels of automotive electronic components.

[Car navigation system]

CH1 : +B LINE	Power is continuously being supplied from the battery to components such as clocks and memory.
CH2 : ACC LINE	A car navigation system's power supply is turned ON via the ignition switch's ACC contact. In this condition, it becomes possible to make navigation settings, listen to music, and perform other operations.
CH3 : ILL LINE	Power supply line (ILL) that directly pulls up +B, IG, and ACC. It is a backup power supply line.



■ **Example of using synchronized operation**



Power Supply Controller

PIA4800 Series

GPIB RS232C DRIVERS CE

*Refer to page 8
PIA4830 only

PIA4810 PIA4820 PIA4830

Dimensions / Weight

PIA4810, PIA4820: 141.9(5.59″)W × 123.4(4.86″)H × 350(13.78″) Dmm(inch) / 5kg(11.02 lbs)
PIA4830: 70.4(2.77″)W × 123.4(4.86″)H × 350(13.78″) Dmm(inch) / 2kg(4.41 lbs)

Accessories

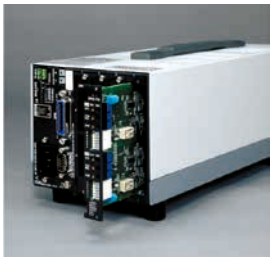
Operation Manual, CD-R(Contains Connection & programming Guide), AC power cord, TP-BUS connector, TP-BUS core, PIA4800 Utilities CD (Included for Model PIA4810 and PIA4830)
OP01-PIA: Flat cable, connector kit (2 pcs.), Connector hood cover (2 pcs.)

■ Control Board

OP01-PIA

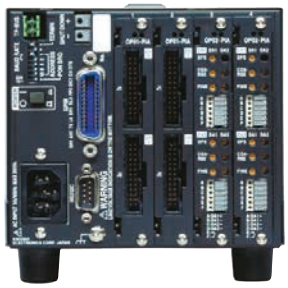
OP02-PIA

Supporting Multiple Channels



The PIA4810 is a power supply controller capable of analog and digital control. It is equipped with the GPIB and RS232C interfaces and 4 slots, which allow 4 each of the PIA4800 Series-specific control boards to be installed. A control board is capable of analog control of 2 channels of DC power supplies or electronic loads; a total of 8 channels can be controlled.
Moreover, DC power supplies with a digital remote-control function, such as the Kikusui PWR, PAS and PMR Series, can be directly connected to the PIA4830 via a TP-BUS (twisted pair bus), enabling a system up to 32 channels to be controlled digitally.
The PIA4820 is an expansion unit that can be connected to the PIA4810 or PIA4830 via a TP-BUS to provide additional control channels. In the same way as the PIA4810, it allows a maximum of 4 control boards to be installed.
Then it is possible to use up to 3 units of the PIA4820 as an expansion that can be connected to the PIA4810 via the TP-BUS, the system is capable of controlling a maximum of 32 channels. Moreover, the combined use of the GPIB and TP-BUS allows the system to control a maximum of 448 channels.
The PIA4830 is a power supply controller only for digital control. It is capable of digitally controlling a system up to 32 channels of such Kikusui PWR, PAS and PMR Series DC power supplies via the TP-BUS.
The OP01-PIA and OP02-PIA are control boards designed exclusively for the PIA4810 and PIA4820. A single control board is capable of analog control of 2 channels of DC power supplies or electronic loads. The OP01-PIA is a full-control board with voltage and current setting and read-back functions, while the OP02-PIA4800 has only the voltage and current setting feature.

Rear Panel



PIA4810

PIA4820

PIA4830

Control Description

■ OP01-PIA

Applied Series	PAD-LA	PAN-A *2			PMC-A	
Connection Type	PAD-LA(1)	PAN-A(1)	PAN-A(2)	PAN-A(3)	PMC-A(1)	PMC-A(2)
Connection Method (Those marked with are options.)	Flat cable accompanying OP01-PIA or optional flat cable SC01-10/20			Provided by the user Connector accompanying OP01-PIA	Shielded cable SC05-PIA *3	
Peripheral options	TU02					
Output Voltage setting	✔			✔	✔	
Output Current setting	✔			✔	✔	
Output Voltage readback	✔				✔	
Output Current readback					✔	
Overvoltage protection setting						
Output ON/OFF	✔					
POWER switch OFF						
Remote/Local switching						
Power switch OFF monitoring					✔	
C.V mode monitoring	▲*1				✔	
C.C mode monitoring	▲*1				✔	
Output ON/OFF monitoring					✔	
Overvoltage protection startup monitoring						
Overheat monitoring						
Alarm monitoring	▲*1				✔	

■ OP02-PIA

Applied Series	PAN-A	PMC-A	PAD-LA
Connection	PAN-A(4)	PMC-A(3)	PAD-LA(2)
Connection Method	Twisted wire (provided by the user)	Option SC04-PIA	2 wires flat cable
Output voltage setting	✔	✔	✔
Output current setting	✔	✔	✔
Output ON/OFF	✔	✔	✔

■ For Digital Control via TP-BUS Connection

Applied Series	PWR	PAS
Output voltage setting	✔	✔
Output current setting	✔	✔
Queries the output voltage value	✔	✔
Queries the output current value	✔	✔
Output voltage readback	✔	✔
Output current readback	✔	✔
Designation / Queries of output channel number		
Designation of output channel number to be displayed		
Overvoltage protection startup monitoring setting	✔	✔
Queries the overvoltage protection startup monitoring	✔	✔
Overcurrent protection startup monitoring setting	✔	✔
Queries the overcurrent protection startup monitoring	✔	✔
Output ON/OFF	✔	✔
Queries the output ON/OFF	✔	✔
Power switch OFF	✔	✔
Panel Lock ON/OFF	✔	✔

✔ : controllable
No mark: not controllable
▲ : controllable under certain conditions

*1: A DIN connector is required (Some types are not supported). (Available as factory option)
*2: OP01-PIA cannot control models with a rated output voltage exceeding 500 V.
*3: In regard to the previous models (with a 14-pin connector), please use SC03-PIA. In this case, Only 2 items, “Output voltage setting” and “Output current setting,” can be controlled.
*4: Accuracy 5 % of FS

Options

■ Terminal Unit

TU01-PIA
TU02-PIA

*TU01-PIA: Exclusive for Model: PAD-L/LP Series
*TU02-PIA: Exclusive for Model: PAN-A Series/ PAD-LA Series

■ Shielded 26 P Flat Cable

SC01-10
SC01-20

*SC01-10: 1 m length/*SC01-20: 2 m length (OP01-PIA, PAD-LA, PAD-L/LP and PAN-A compatible)

■ 2-core shielded cable

SC03-PIA
SC04-PIA
SC05-PIA

SC03-PIA SC04-PIA SC05-PIA

SC03-PIA: (OP01-PIA, PMC-A compatible, about 1.0 m/for 14-pin)
SC04-PIA: (OP02-PIA, PMC-A compatible, about 1.0 m)
SC05-PIA: (OP01-PIA, PMC-A compatible, about 1.0 m/for 26-pin)

■ GPIB cables (Available for all models)

408J-101 (about 1.0 m)
408J-102 (about 2.0 m)
408J-104 (about 4.0 m)

Power Supply Controller

PIA4850

USB DRIVERS CE

*Refer to page 8

Dimensions / Weight

95(3.74″)W × 18(0.71″)H × 58(2.28″)Dmm(inch) /100 g(0.22 lbs)

Accessories

CD-R (Contains Instruction Manual, Driver Files, Sample Programs, etc.), Magnet sheet for fastening the base, TP-BUS connector, TP-BUS cable (1 m), USB cable (1 m)

Control Description

✔ : controllable
No mark : not controllable

DC Power Supply Series	PWR	PAS
Output voltage setting	✔	✔
Output current setting	✔	✔
Query for output voltage setting value	✔	✔
Query for output current setting value	✔	✔
Output voltage value read-back	✔	✔
Output current value read-back	✔	✔
Designation/Query of output channel number		
Designation of output channel number to display		
Overvoltage protection activation point setting	✔	✔
Query for overvoltage protection activation point	✔	✔
Overcurrent protection activation point setting	✔	✔
Query for overcurrent protection activation point	✔	✔
Output ON/OFF	✔	✔
Power switch shutoff	✔	✔
Panel lock ON/OFF	✔	✔

Required Drivers and Components

		WAVY application software	VB, VBA, VC++ LabVIEW
VISA (including USB-TMC driver)		Required	Required
PIA4800 instrument driver	IVI-COM/C	Not required	Required in some cases
	IVI Shared Components		

● The latest drivers available at the Kikusui website.

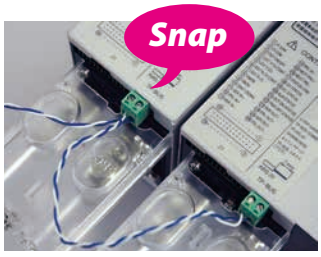
Digital control of DC power by USB!

The PIA4850 is a power supply controller with USB interface to control Kikusui DC power supply through the TP-BUS.
For those power supplies, PAS Series, PWR Series or other models that equips the TP-BUS can be digitally controlled by the PC, as well as for read-back of output values and status monitoring. It operates using bus power and with its simple system and compact structure, you can use it whenever you need an easy setup.

Features

- USB 2.0 compatible.
- Can be used with Windows10/8/7/Vista/XP/2000.
- Operates using bus power. Requires no AC adapter.
- Bus power operation. No AC adapter is required.
- Allows read-back of output values and status monitoring.
- Capable to control up to 32*1DC power supplies that equip TP-BUS*2 (Different power supply models can be combined) TP-BUS connection can be extended up to 200 m. Ideal for remote monitoring!

Includes a magnet sheet to hold the device in place. Can be attached directly to the power supply.



The TP-BUS utilizes a daisy-chain connection. This makes adding power supplies easy and keeps cables neatly together.

Specifications

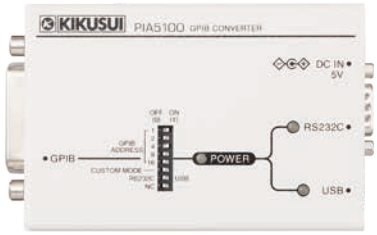
Item	Details	
TP-BUS	Connections	The connections given below are possible using the provided TP-BUS connector Expansion unit PIA4820: 4 units can be connected (Extension length: Maximum 200 m, Twist count: 1 time/cm or more)
	Number of controlled units*1	PAS Series : Maximum 32 units PWR Series: Maximum 32 units
	Polarity	None
	Conforming power wiring	Twisted wire: 0.32 mm² (AWG22) Extended length: Maximum 200 m 0.20 mm² (AWG24) Extended length: Maximum 20 m
USB		Conforms to USB 2.0 specifications, and to USBTMC-USB488 device class specifications. Communications speed: 12 Mbps (full speed) (High power device (power consumption: 200 mA)
OS		Windows8, Windows7 (32-bit versions) Windows2000 Professional (SP4 or later) Windows XP Professional (SP2 or later, 32-bit versions) Vista Home Premium, Business, Ultimate (32-bit versions)
VISA specifications		Ver. 3.0 or higher
Operating ambient temperature/ Humidity range		0 °C to 40 °C, 10 % rh – 90 % rh (No condensation.)
Storage ambient temperature/ Humidity range		-20 °C to 70 °C, 10 % rh – 90 % rh (No condensation.)
Installation location		Indoors, maximum height 2000 m
Safety		Conforms to Low-Voltage Directive 2014/35/EU, EN61010-1 Protection Class I, Pollution Degree 2.

*1: The maximum controllable units are 31 when the connections include PMR series unit.
*2: TP-BUS (Twist-Pair BUS) is an original Kikusui interface.

Power Supply Controller

PIA5100

GPIB



Dimensions / Weight

108(4.25″)W×30(1.18″)H×72(2.83″)Dmm(inch) /200 g(0.44 lbs)

Accessories

Power cord set (Input power cord (length: approx. 50 cm), USB Btype-EIAJ#2 adapter for input power supply), Magnetic sheet, Operation manual

Measuring Instruments/power supplies Whose Operations Have Been Checked

Model name	Recommended settings
PLZ5W Series Electronic Load	GPIB-CONV settings: RS232, CUSTOM MODE OFF
PWR-01 Series Regulated DC Power Supply	GPIB-CONV settings: RS232, CUSTOM MODE OFF Queries need to be inserted periodically to avoid buffer overrun.
PWX Series Regulated DC Power Supply	GPIB-CONV settings: RS232, CUSTOM MODE OFF Queries need to be inserted periodically to avoid buffer overrun.
PMX Series Regulated DC Power Supply	GPIB-CONV settings: RS232, CUSTOM MODE OFF Queries need to be inserted periodically to avoid buffer overrun.
PCZ1000A AC Electronic Load	GPIB-CONV settings: RS232, CUSTOM MODE ON CUSTOM MODE settings: Bitrate = 9600 Stopbits = 2 Flow Control = Software Termination Character = 0x0A 488.2 Block Transfer = No IDN Query = IDN? KISTD Mode = No Queries need to be inserted periodically to avoid buffer overrun.

(as of August 2020)

If considering series other than those described above, please contact our office.

Specifications

GPIB port
GPIB specifications.....IEEE488.1-1987
USB port
USB specifications .....Standard type A socket, USB1.1 Full-Speed
RS232C port
UART specifications.....Dsub 9 pin
(Crossover cable connection with the measuring instrument/power supply)
SERVICE PORT connector
USB specifications .....Mini B type socket, USB1.1 Full-Speed
General specifications
Input power supply .....5 V 0.25 A
DC IN 5V connector.....EIAJ#2
Operating temperature range ....0 °C to 50 °C (32 °F to 122 °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)

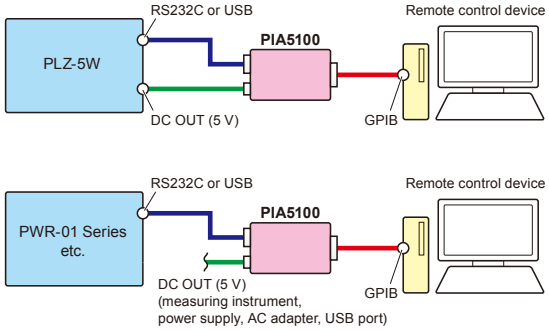
Simple conversion from RS232C/USB to GPIB

The PIA5100 is an interface converter that allows for instruments without a GPIB interface to be easily controlled through RS232C or USB. This converter allows for communication with IEEE488.2 compatible measuring instruments and power supplies while removing the need for difficult configuration. Instruments not compatible with IEEE488.2 are also supported through communication programming in custom mode.
*Limited to equipment based on USB-TMC

Features

- Converts RS232C or USB interface to IEEE488.2 GPIB
- Easily connected with no driver required
- Communication conditions can be changed in custom mode

Connection example



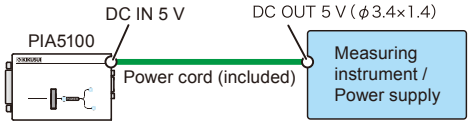
*The PLZ-5W has DC 5 V supply function. Other products require DC 5 V supply.

Power Supply Methods

DC 5 V is required for PIA5100 operations. Please prepare one of the following power sources (power supply methods).

■ Power supply from the instrument / power supply

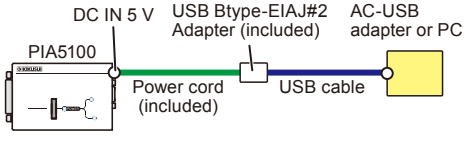
If the measuring instrument/power supply has a DC OUT 5 V connector, you can use the supplied input power cord to supply power from the instrument/power supply.



*Currently, the product with DC 5 V supply function is the PLZ-5W,PLZ-5WH.

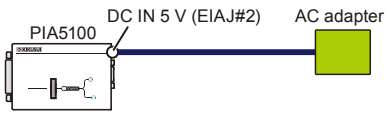
■ Power supply from the USB port

You can use the power cord set provided to supply power from an AC-USB adapter or a PC USB port.



■ Power supply from the AC adapter

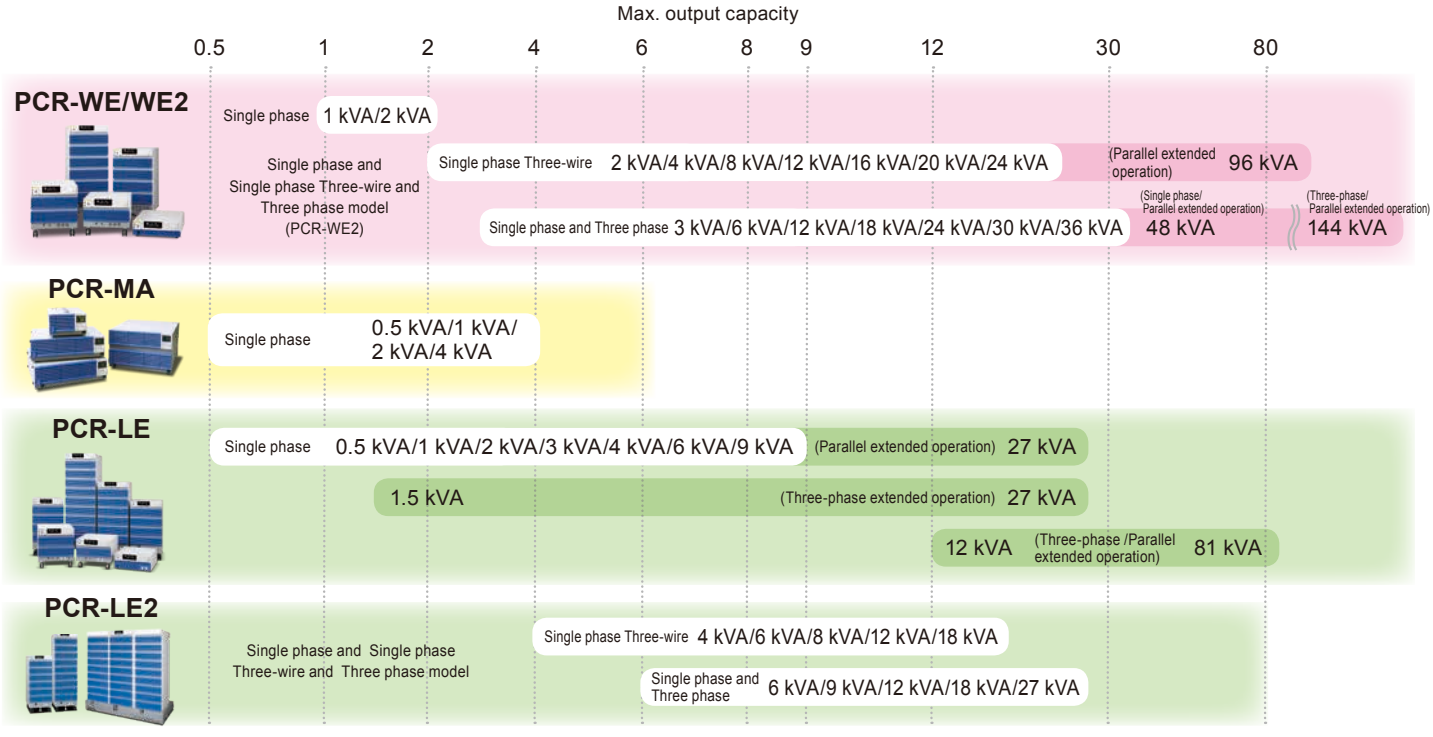
The AC adapter can be used to supply power.



AC POWER SUPPLY SELECTION GUIDE

Series		PCR-WE/WE2 (PCR-WE2..."Single-phase", "Single-phase, Three-wire", and "Three-phase")	PCR-MA	PCR-LE	PCR-LE2 (Selectable model for "Single-phase", "Single-phase, Three-wire", and "Three-phase".)
Line up		Single phase: 1 kVA /2 kVA Single phase and three phase: 3 kVA /6 kVA /12 kVA /18 kVA /24 kVA /30 kVA /36 kVA Single phase three-wire: 2 kVA /4 kVA / 8 kVA /12 kVA /16 kVA /20 kVA /24 kVA	Single phase: 500 VA /1 kVA /2 kVA /4 kVA	Single phase: 500 VA /1 kVA /2 kVA /3 kVA / 4 kVA /6 kVA /9 kVA	Single phase and three phase: 6 kVA /9 kVA /12 kVA /18 kVA /27 kVA Single phase three-wire: 4 kVA /6 kVA /8 kVA /12 kVA /18 kVA
Features		Compact and light weight High efficiency High-performance	Compact and light weight	High-performance	
Application		Aging test, Stabilization of power line, Voltage variation test, Grid interconnection test for the application of New Energy field.	Personal equipments Field service equipments	Voltage variation test Grid interconnection test for the application of New Energy field	
Sections using these...		Production, Research and Development Adjustment, Inspection line Production line, Quality assurance Maintenance service	Development Service Production	Research and Development Adjustment, Inspection line Production line, Quality assurance Maintenance service	
Circuit Method		PWM inverter system	PWM inverter system	Linear amplifier system	
Parallel extended operation		Available for models of 6 kVA or more.*1 Maximum 48 kVA per phase. Can be expanded up to 144 kVA with a parallel operation cable.	N/A	Available in the model of 2 kVA or more.*1 (Main units + PD05M-PCR-LE and PD05S-PCR-LE) Max. 27 kVA	N/A
Single phase three-wires / Three-phase extended operation		Available in single-phase, three-phase and three-wire models (PCR-WE2)	N/A	The operation in single-phase three-wires or three-phase is possible by the use of the option. (Three-phase: Main unit + 3P05-PCR-LE) Max. 81 kVA (Single-phase three-lines: Main unit + 2P05-PCR-LE) Max. 54 kVA	The output can be switched on the front panel.
Output Voltage and Frequency *2		AC 0 V to 310 V, 1 Hz to 5000 Hz	AC 0 V to 310 V, 40 Hz to 500.0 Hz	AC 0 V to 300 V, 1 Hz to 999.9 Hz	
		DC 0 V to ±438 V	DC 0 V to ±438 V	DC 0 V to 424 V	
Efficiency		82 % to 85 % (TYP)	70 % or more	54 % to 58 % or more	58 % or more
Output voltage response speed (typical)		FAST: 55 µs, MEDIUM: 100 µs, SLOW: 300 µs	150 µs	FAST: 20 µs*3 MEDIUM: 30 µs	MEDIUM: 30 µs*4 , 50 µs*5
Maximum Output Peak Current (AC mode) *6		Four times the maximum current *7	Three times the maximum current	Four times the maximum current (TYP)	
Interfaces	GPIB	Option	Option	Option	
	RS232C	✔	N/A	✔	
	USB	✔	✔	Option	
	LAN	✔	✔	Option	

*1: Combinations of different models are possible. *2: It is possible to set and operate the output voltage from 0 V *3: Excluding 6 kVA and 9 kVA model
*4: PCR6000LE2/PCR9000LE2 *5: PCR12000LE2/PCR18000LE2/PCR27000LE2 *6: For capacitor-input rectifier loads (however, this is also limited by the rated output current's rms value).
*7: Depending on load input impedance



Ultra-Compact AC/DC Power Supply (CV/CF)

PCR-WE/WE2 Series

LAN LXI USB RS232C GPIB OPTION CE

*Refer to page 8

Dimensions / Weight

PCR1000WE: 430(16.93″)W X 129.2(5.09″)H X 655(25.79″)Dmm/ 16kg(35.27lbs)
PCR2000WE: 430(16.93″)W X 129.2(5.09″)H X 655(25.79″)Dmm/ 20kg(44.09lbs)
PCR3000WE2: 430(16.93″)W X 129.2(5.09″)H X 655(25.79″)Dmm/ 23kg(50.71lbs)
PCR6000WE2R: 430(16.93″)W X 262(10.32″)H X 550(21.65″)Dmm/ 42kg(92.59lbs)
PCR6000WE2: 430(16.93″)W X 262(10.32″)H X 550(21.65″)Dmm/ 43kg(94.80lbs)
PCR12000WE2R: 430(16.93″)W X 389(15.32″)H X 550(21.65″)Dmm/ 66kg(145.51lbs)
PCR12000WE2: 430(16.93″)W X 389(15.32″)H X 550(21.65″)Dmm/ 65kg(143.3lbs)
PCR18000WE2R: 430(16.93″)W X 690(27.17″)H X 550(21.65″)Dmm/120kg(264.56lbs)
PCR18000WE2: 430(16.93″)W X 690(27.17″)H X 550(21.65″)Dmm/120kg(264.56lbs)
PCR24000WE2R: 430(16.93″)W X 690(27.17″)H X 550(21.65″)Dmm/130kg(286.60lbs)
PCR24000WE2: 430(16.93″)W X 690(27.17″)H X 550(21.65″)Dmm/130kg(286.60lbs)
PCR30000WE2R: 430(16.93″)W X 944(37.17″)H X 550(21.65″)Dmm/160kg(352.74lbs)
PCR30000WE2: 430(16.93″)W X 944(37.17″)H X 550(21.65″)Dmm/160kg(352.74lbs)
PCR36000WE2R: 430(16.93″)W X 944(37.17″)H X 550(21.65″)Dmm/180kg(396.83lbs)
PCR36000WE2: 430(16.93″)W X 944(37.17″)H X 550(21.65″)Dmm/170kg(374.79lbs)

*6 kVA in a 6U frame and up to 36 kVA in a single unit with regenerative capabilities.*1 The next generation of high-power programmable AC power supplies.*

The PCR-WE/WE2 is a series of compact, high-power switching AC power supplies that brings high power in small packages. The 15 model line-up ranges from 1 kVA to 36 kVA AC/DC with switchable single & 3 phase output from 6 kVA and up. The PCR-WE/WE2 series also features a regenerative mode*1 that can drastically reduce power consumption and cut operating costs. The PCR-WE/WE2 supports mix-and-match parallel operation*2 up to 144 kVA for large-scale test systems.

*1 Only "R" models (PCR-WE2R) with 3-phase 200 V input. Regeneration on premises only.
*2 Parallel operation is available for 6 kVA models and up with a maximum of 4 units. Same model combination is not required. If the input wiring system is the same, parallel operation is possible even among models with different power capaci-ties. Up to 48 kVA per phase.

Features

- Compact size: 6 kVA in 6U (PCR6000WE2)
- Up to 36 kVA in a single unit
- 100% Regenerative-power capability*1
- Mix-and-match parallel operation up to 144 kVA . Same model set up is not required (6 kVA or more)
- Flexible digital interface: LAN (LXI), USB, RS232C, GPIB (factory option)
- Power line disturbance simulation features
- Sequence function for advanced simulation
- External analog, digital control function (standard)
- Power-saving function
- DC output (100% of rated power)
- Output frequency up to 5 kHz
- Output rating: AC 0 to 310 Vrms, DC 0 to ±438 V

*1 Only "R" models (PCR-WE2R) with 3-phase 200 V input. Regeneration on premises only.

Accessories

Cable tie, External control (DIGITAL I/O) connector, Heavy object warning label, Read This First!, Quick Reference, CD-ROM, Safety Information

*Power cord is not included for the PCR-WE/WE2 Series. Please purchase the optional accessory separately.

Specifications

Model	Input rating(AC rms values)				Output rating, AC mode					Output rating, DC mode			Weight
	Phase	Voltage	Apparent power	Current	Phase	Voltage	Max. current*3 (L/H range)	Power capacity	Frequency	Voltage	Max. current*4 (L/H range)	Power capacity	kg/lb
		V	kVA or less	A or less		V	A	kVA	Hz	V	A	kW	
PCR1000WE	1Φ	85 to 132/ 170 to 250 (100 V input type or 200 V input type)	1.4	17/8.5	1Φ	(Specification guaranteed voltage range) 1 to 155/ 2 to 310 (L/H output range) (Voltage setting range) 0 to 157.5/ 0 to 315.0	10/5	1	1 to 5 k	(Specification guaranteed voltage range) ±1.4 to ±219/ ±2.8 to ±438 (L/H output range) (Voltage setting range) -222.5 to +222.5/ -445.0 to +445.0 (L/H output range)	10/5	1	16/35.27
PCR2000WE			2.7	32/16	1Φ		20/10	2			20/10	2	20/44.09
PCR3000WE2			4	48/24	1Φ		30/15	3			30/15	3	23/50.71
					3Φ		10/5						
					1Φ3wire			2					
PCR6000WE2R	3Φ3wire	3Φ3wire Input model (PCR-WE2R) 170 to 250 (3Φ line voltage) 3Φ4wire Input model (PCR-WE2) 323 to 519 (3Φ line voltage)	7.8	27	1Φ		60/30	6			60/30	6	42/92.59
PCR6000WE2	3Φ4wire			14	3Φ		20/10						43/94.80
					1Φ3wire			4					
PCR12000WE2R	3Φ3wire		15.6	53	1Φ		120/60	12			120/60	12	66/145.5
PCR12000WE2	3Φ4wire			28	3Φ		40/20						65/143.3
					1Φ3wire			8					
PCR18000WE2R	3Φ3wire		23.4	80	1Φ		180/90	18			180/90	18	120/ 264.56
PCR18000WE2	3Φ4wire			42	3Φ		60/30						
					1Φ3wire			12					
PCR24000WE2R	3Φ3wire		31.2	106	1Φ		240/120	24			240/120	24	130/ 286.60
PCR24000WE2	3Φ4wire			56	3Φ		80/40						
					1Φ3wire			16					
PCR30000WE2R	3Φ3wire		39	133	1Φ		300/150	30			300/150	30	160/ 352.74
PCR30000WE2	3Φ4wire			70	3Φ		100/50						
					1Φ3wire			20					
PCR36000WE2R	3Φ3wire		46.8	159	1Φ		360/180	36			360/180	36	180/396.83
PCR36000WE2	3Φ4wire			84	3Φ		120/60						170/374.79
					1Φ3wire			24					

*3 When the output phase voltage is between 100 V and 155 V or 200 V and 310 V, the output current is reduced by the output voltage. When the output frequency is between 1 Hz to 40 Hz, the output current is reduced by the output frequency. *4 When the output voltage is between 100 V to 219 V or 200 V to 438 V, the output current is reduced by the output phase voltage.
★ The 500Hz Limit Model is available. The PCR-WE2 Series offers the type on each model that limits the maximum output frequency up to 500 Hz.

Functions

■ Regeneration function

*Only for 3-phase 200 V input models with “R” in the model name.
Regenerative capabilities of the PCR-WE have been increased to 100%, despite being a switching inverter power supply. 100% regenerative capabilities have been achieved with no limitations in reverse load flow time.

■ Low ripple noise

Low ripple noise performance achieved despite switching inverter.

■ Eco function (energy-saving function)

The series is equipped with a sleep mode that reduces overall power consumption after a certain amount of time with no output, as well as an energy saving mode that only draws power from necessary modules resulting in reduced power consumption and cost of operation.

■ DC output – 100% of rated power

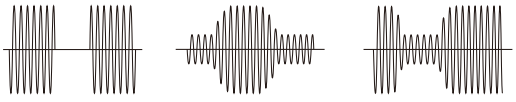
In addition to AC output, DC output as well as AC+DC output are available for a wide range of industries including R&D in the chemistry and physics fields.

■ Various measurement functions

Output effective value voltage/current, peak voltage/current, effective power/apparent power and power factor can be measured. Harmonic analysis (up to the 50 th harmonic) of output voltage/current is possible.

● Power line abnormality simulation

This feature allows the PCR-WE/WE2 series to simulate power line abnormality simulation including power outtages, voltage dips, and voltage pops. This can be used to test switching power supplies and other electronic equipment.



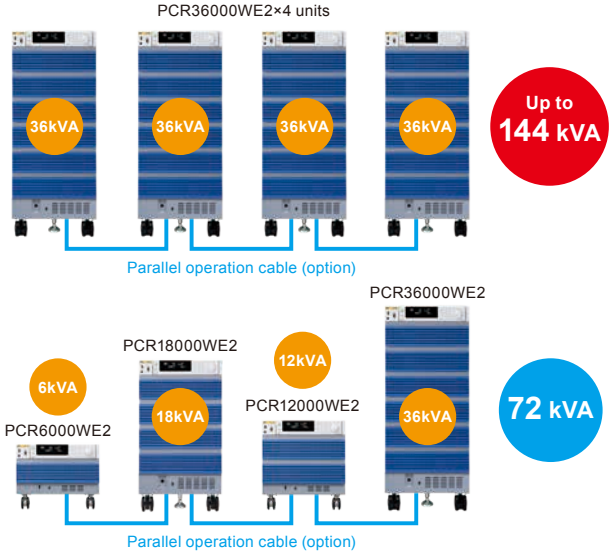
power outage　voltage increase(pop)　voltage drop(dip)

● Various communication interface options

LAN, USB and RS232C standard digital interface.
GPIB is available as an optional interface board.

● Parallel operation function

Parallel operation among all models available up to 144 kVA (maximum 4 units).
*Input voltage must be the same for models 6kVA and higher



[NOTICE] To users of the PCR-L/LA/LE Series

The PCR-WE/WE2 Series is not compatible with the previous product, the PCR-L/LA/LE Series. Consequently, it is not possible to upgrade a system if it includes a prior PCR-L/LA/LE Series in the system. Also, in general, options cannot be used (with some exceptions.) Please consider this when planning your future system.
If you have any other questions, please contact our sales department for details.

Options

■ Input power cable

AC5.5-1P3M-M6C-3S (For PCR1000WE/2000WE(1P2W input))
AC14-1P3M-M6C-3S (For PCR3000WE2(1P2W input))
AC5.5-1P3M-M5C-4S (For PCR6000WE2R(3P3W input))
AC5.5-1P3M-M5C-5S (For PCR6000WE2/PCR12000WE2(3P4W input))
AC14-1P3M-M5C-4S (For PCR12000WE2R(3P3W input))
AC22-1P3M-M8C-4S (For PCR18000WE2R(3P3W input))
AC8-1P3M-M5C-5S (For PCR18000WE2(3P4W input))
AC38-1P3M-M8C-4S (For PCR24000WE2R(3P3W input))
AC14-1P3M-M5C-5S (For PCR24000WE2(3P4W input))
AC60-1P3M-M8C-4S (For PCR30000WE2R/36000WE2R(3P3W input))
AC22-1P3M-M5C-5S (For PCR30000WE2/36000WE2(3P4W input))

■ GPIB interface board

IB07-PCR-WE

■ Base hold angle

OP03-KRC

■ Parallel operation cable

PC01-PCR-WE(1 m)

■ Power linkage cable

LC01-PCR-LE(1 m)

■ External control connector

OP01-PCR-WE(DIGITAL I/O)
OP02-PCR-WE(ANALOG I/O)

■ Sequence creation software

SD032-PCR-WE(Wavy for PCR-WE)

■ Avionics test software

SD012-PCR-LE/WE

■ Remote control software for the Windows tablet

SD021-PCR-LE/WE

■ Quick immunity sequencer 2

SD009-PCR-LE/WE

■ Rack mount brackets

For PCR1000WE/2000WE/3000WE2
KRB3-TOS (EIA inch rack)
KRB150-TOS (JIS millimeter rack)
For PCR6000WE2(R)
KRB6 (EIA inch rack)
KRB300 (JIS millimeter rack)
For PCR12000WE2(R)
KRB9 (EIA inch rack)
KRB400-PCR-LE (JIS millimeter rack)

Output Terminal Box NEW

PCR-WE/WE2 installation example

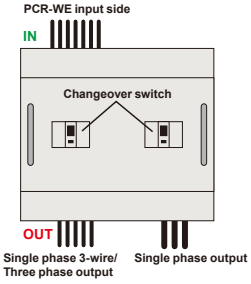
■ Output terminal box

OT01-PCR-WE(18 kVA)
OT02-PCR-WE(36 kVA)

An output terminal box gives output mode selection “single-phase, single-phase 3-wire and three-phase” of PCR-WE/WE2 series. Selectable switches equipped in its body achieve multi-phase output without output cable re-wiring.

■ Connecting cable

AC14-7P0.7M-M5M6 (For 6 k, 12 kVA(0.7 m))
AC14-7P1.4M-M5M6 (For 6 k, 12 kVA(1.4 m))
AC22-7P0.7M-M6M6 (For 18 kVA(0.7 m))
AC22-7P1.4M-M6M6 (For 18 kVA(1.4 m))
AC22-7P0.7M-M6M8 (For 24 kVA(0.7 m))
AC22-7P1.4M-M6M8 (For 24 kVA(1.4 m))
AC38-7P0.7M-M8M8 (For 30 k, 36 kVA(0.7 m))
AC38-7P1.4M-M8M8 (For 30 k, 36 kVA(1.4 m))



Connection concept diagram

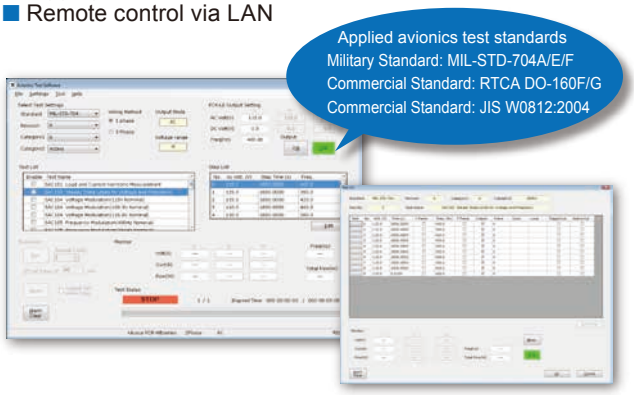
*This output terminal box does not include CE qualification.
When creating the power system with this terminal box, the PCR-WE/WE2 is not valid for CE standards.

To maximize the features and performance of the PCR-WE/WE2 Series, various types of software are available depending on the testing applications.

For Avionics Test Application
SD012-PCR-LE/WE
Avionics Test Softwere

Supporting to the compliance testing of the avionics test standard.
The test pattern can be conducted from the Library.

- Easy configuration - just select standard from library
- Test step editing and saving - convenient for development and evaluation required with marginal testing
- Test condition reporting function - enables test history logging
- Remote control via LAN



EMC IEC61000-4

Power Line Disturbance Immunity Testing Software
SD009-PCR-LE/WE
Quick Immunity Sequencer2

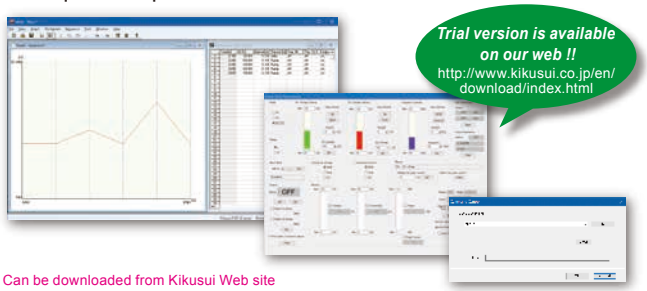
- Capable of performing the compliance testing applied to the IEC6100-4-11, 4-13, 4-14, 4-17, 4-27, 4-28, 4-29, 4-34 or to perform preliminary test before the standard testing.
- Applied to Single-phase/ Single-phase three-wire/ Three-phase and the DC input power.
- Not only for the compliance standard testing, it can be also employed for advance checking in development phases and for margin tests.
- Sequence chain (up to 10 sequences) features to improve the test efficiency
- Waveform preview provides a general idea of the output wave-form without having an oscilloscope
- The setting condition file and the test result file can be saved in txt or csv format.

The latest standards for IEC61000-4 supported!

Wavy

Sequence creation software
SD032-PCR-WE
Wavy for PCR-WE

- It makes it easier to create or edit the test condition file required for the sequence operation.
- By using the storage function of test condition data file, it enables you to manage the test condition of the standard routine test.
- The progress of execution sequence will be displayed on the "practical dialogue" with the setting value and the cursor.
- It is possible to observe the intuitionistic output through by the "monitor graph" that plots the ongoing monitor value.
- You can save the acquired monitor data as a test result.
- Newly added features of "Sequence Pre-view Dialog" enables you to confirm the waveform before executing the sequence operation.



Can be downloaded from Kikusui Web site

Remote control software for the Windows tablet
SD021-PCR-LE/WE
RMT CONT SOFTWARE FOR PCR-LE

The Windows tablet can be used as a remote controller !

The software that can control the PCR-WE/WE2 Series. It is capable of changing the setting condition of the "wiring method", "output mode",
"voltage range", "voltage value", and "frequency value". These settings changed by the remote controller can be saved and recalled. Moreover, it can display the measurement value of the AC power supply. The remote operation and control of the AC power supply from the distance can be easily realized.

Screen display (main screen)

● Operating Environment : Intel Core 2 or later / Windows 8.1 / Memory 4GB / Storage 128GB / Display resolution 1366 x 768 or higher / USB port

Compact AC Power Supply (CV/CF)

PCR-MA Series

LAN LXI USB GPIB OPTION DRIVERS CE

*Refer to page 8

Compact AC power supply using the PWM inverter method

The PCR-MA AC power supply series is a PWM inverter type (switching) power supply that builds on the success of our conventional model, the PCR-M. Maximum output voltage has been increased to 310Vrms AC while maintaining a compact, portable design. The digital interface now includes LAN (LXI) and USB as standard, with GPIB as a factory option for easy integration into any test system. The LXI compliant LAN interface allows the operator to easily monitor and control the instrument via virtual interface wherever they are. Various features including a remote sensing function have been introduced to ensure precise voltage and current measurements. Other features including DC mode, memory functions, and various protections make the PCR-MA the most accessible AC power supply on the market.

Dimensions / Weight

PCR500MA: 214(8.43″)W×124(4.88″)H×350(13.78″)Dmm(inch)/ 6.5 kg(14.33 lbs)
PCR1000MA: 429(16.89″)W×128(5.04″)H×350(13.78″)Dmm(inch)/ 11 kg(24.25 lbs)
PCR2000MA: 429(16.89″)W×128(5.04″)H×450(17.72″)Dmm(inch)/ 16 kg(35.27 lbs)
PCR4000MA: 429(16.89″)W×262(10.31″)H×520(20.47″)Dmm(inch)/ 32 kg(70.54 lbs)

Accessories

Power cord, Cable tie(1 pc.), Core(1 pc.), Packing List(1 pc.), Quick Reference(Japanese 1 sheet, English 1 sheet), Safety Information(1 copy), CD-ROM(1 disc), Heavy object warning label(1 pc.)(Included only with the PCR4000MA)

Specifications

Model	Input rating(AC rms values, single phase)				Output rating, AC mode				Output rating, DC mode			Weight
	Voltage	Apparent power	Current		Voltage	Max. current *1	Power capacity	Frequency	Voltage	Max. current *2	Power capacity	kg/lb
	V	Approx.	A		V	A	VA	Hz	V	A	W	
PCR500MA	90 to 132/ 180 to 264 (auto detection at power-on)	0.8 kVA	8/6.3 or less (90 V/115 V)	4/3.2 or less (180 V/230 V)	0 to 155 /0 to 310 (output 155 V/ 310 V range) (Voltage setting range) 0 to 157.5/0 to 315	5/2.5	500	40.0 to 500.0	-219 to +219/ -438 to +438 (output 155 V/ 310 V range) (Voltage setting range) -222.5 to +222.5/ -445.0 to +445.0	4/2	400	6.5/14.33
PCR1000MA		1.6 kVA	16/12.5 or less (90 V/115 V)	8/6.3 or less (180 V/230 V)		10/5	1000			8/4	800	11/24.25
PCR2000MA		3.2 kVA	32/25 or less (90 V/115 V)	16/12.5 or less (180 V/230 V)		20/10	2000			16/8	1600	16/35.27
PCR4000MA		6.4 kVA	64/50 or less (90 V/115 V)	32/25 or less (180 V/230 V)		40/20	4000			32/16	3200	32/70.54

*1: For an output voltage of 1 V to 100 V/2 V to 200 V. Limited by the power capacity when the output voltage is 100 V to 155 V/200 V to 310 V.
*2: For an output voltage of 1.4 V to 100 V/2.8 V to 200 V. Limited by the power capacity when the output voltage is 100 V to 219 V/200 V to 438 V.

Options

■ GPIB interface Board
IB22

■ Analog interface Board
EX08-PCR-MA

■ Rack-mount frames and brackets

For the PCR500MA
KRA150 (for JIS metric size)
KRA3 (for EIA inch size)
KBP3-2 (Blank panel)
For the PCR1000MA and PCR2000MA
KRB150-TOS (for JIS metric size)
KRB3-TOS (for EIA inch size)
For the PCR4000MA
KRB300 (for JIS metric size)
KRB6 (for EIA inch size)

Features

■ Compact design (PCR500MA)

Small enough to fit on your work desk!
Only 214 W × 124 H × 350 D mm!
Weighs only 6.5 kg and easy to carry!

Neatly fits on your desk!
(Picture) Left: PCR500MA Right: Electronic Load PLZ164W

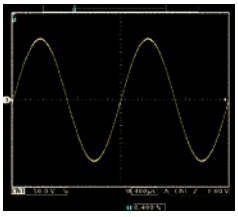
Easy to carry with only one hand

■ Versatile output modes

Three modes (AC, DC, AC+DC) are available. *1
The frequency range is up to 500 Hz (setting resolution: 0.1 Hz).

■ High-quality output waveform

Output voltage available in two ranges: 0-155 V / 0-310 V. The maximum current is 5 A (155 V range) or 2.5 A (310 V range) with a peak current that can triple the maximum rated current for capacitor input type rectifier loads. The distortion rate of the output waveform is below 0.5%. (PCR500MA)



■ Memory feature

Three combinations of setting, voltage, and frequency can be stored and recalled on the front panel. By recalling memory during output, you can test sudden changes in voltage and frequency. Additionally, when using communication commands, the internal memory can store up to 11 settings.

■ Measurement features

Voltage, current, power, apparent power, reactive power, power factor, crest factor and current peak hold can all be measured.*2

■ Various communication interface options

LAN and USB digital interfaces included as standard.
GPIB optional interface board also available.

■ Analog interface

Analog control is also available with an optional analog interface (EX08-PCR-MA). Input DC signals can be used to change output AC voltage and boost the input waveform.

*1: AC+DC mode is only valid with communication command.
*2: You can use the communications interface to measure apparent power (VA), reactive power (VAR), power factor (PF), crest factor (CF), and held current peak.

■ Easy access with the built-in web server

Use a browser from a PC, smartphone, or tablet to access the web server built into the PCR-MA series for convenient control and monitoring.

[Recommended browser]
- Requires for the Microsoft Edge 10
- Requires for the Internet Explorer version 9.0 or later
- Requires for the firefox 8.0 or later
- Requires for the safari/mobile Safari 5.1 or later
- Requires for the Chrome 15.0 or later
- Requires for the Opera 11.0 or later

* Connecting with a smartphone, tablet, etc. requires a Wi-Fi environment (wireless LAN router etc.).

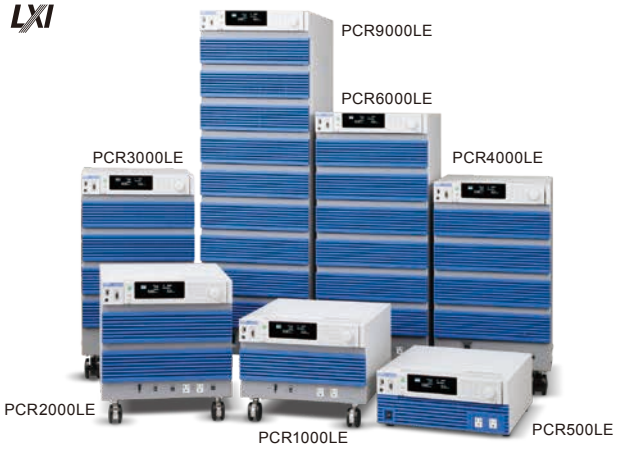
High-performance multifunctional AC Power Supplies

PCR-LE Series

LAN OPTION USB OPTION GPIB OPTION RS232C DRIVERS CE

*Refer to page 8

LXI



New stage of AC power supply supporting new energy field

The PCR-LE Series is a new line of advanced multifunctional AC power supplies that have been developed from the former PCR-L/LA Series (linear amplifier type). The PCR-LE Series provides high reliability and support to various applications by taking advantage of features that can freely control broadband waveform. Moreover, the PCR-LE Series can be configured as a core device of a test system combined with Electronic Loads and Power Analyzers for "Grid Connection Testing" in regard to dispersed power generation, such as Solar Power, Wind Power, Fuel Cell, and Gas Engine referred to as "New Energy Field". With various options, the low frequency immunity test and various power environment tests are supported. The options for parallel operation and three-phase operation enable you to expand a single-phase system up to 27 kVA, single-phase three wires system up to 54 kVA, and a three-phase system up to 81 kVA. The system can be applied to a large-scale EMC site for testing of industrial high-capacity air conditioners.

Dimensions / Weight

PCR500LE : 430(16.93″)W X 173(6.81″)H X 550(21.65″)Dmm(inch) / 17kg(37.48 lbs)
PCR1000LE: 430(16.93″)W X 262(10.31″)H X 550(21.65″)Dmm(inch) / 35kg(77.16 lbs)
PCR2000LE: 430(16.93″)W X 389(15.31″)H X 550(21.65″)Dmm(inch) / 55kg(121.25 lbs)
PCR3000LE: 430(16.93″)W X 690(27.17″)H X 550(21.65″)Dmm(inch) / 82kg(180.78 lbs)
PCR4000LE: 430(16.93″)W X 690(27.17″)H X 550(21.65″)Dmm(inch) / 96kg(211.64 lbs)
PCR6000LE: 430(16.93″)W X 944(37.17″)H X 550(21.65″)Dmm(inch)/140kg(308.65 lbs)
PCR9000LE: 430(16.93″)W X 1325(52.17″)H X 550(21.65″)Dmm(inch) /190kg(418.88 lbs)

Accessories

Setup Guide, Quick Reference (1 each for English and Japanese), CD-R(Contains the User's Manual and the Communication Interface Manual), Safety information PCR500LE : Power cord (with plug, length: 3 m)

Features

- High-quality/high-stability output with a high-speed linear amp
- Capable of various power line abnormality simulations and sequence operation
- Single-phase 500 VA to 9 kVA, supporting the system for the single-phase, and expandable with optional drivers for the single-phase three-wire, and three-phase operation
- Expandable capacity up to 27 kVA (single-phase), 54 kVA (single-phase three-wires), and 81 kVA (three-phase)
- Equipped with various measuring functions
- Features a full range of measuring functions and supports AC, DC, and AC + DC Outputs
- Detachable front panel
- Eco-friendly function equipped

Specifications

Model	Input rating(AC rms values)				AC mode output rating(AC rms values)				DC mode output rating			Weight
	Phase	Voltage	Apparent power	Current	Voltage	Max.Current*	Power capacity	Frequency	Voltage	Max.Current*	Power capacity	kg/lb
		V	Approx. kVA	A	V	A	kVA	Hz	V	A	kW	
PCR500LE	1Φ	85 to 132/ 170 to 250 (100 V input type or 200 V input type)	0.93	11.3/5.5 or less	1 to 150/ 2 to 300 (L/H output range) (Voltage setting range) 0 to 152.5/ 0 to 305.0	5/2.5	0.5	1 to 999.9	±1.4 to ±212/ ±2.8 to ±424/ (Voltage setting range) -215.5 to +215.5/ -431.0 to +431.0	3.5/1.75	0.35	17/37.48
PCR1000LE			1.8	22/10.8 or less		10/5	1			7/3.5	0.7	35/77.16
PCR2000LE			3.6	44/21.5 or less		20/10	2			14/7	1.4	55/121.25
PCR3000LE			5.5	66/32 or less		30/15	3			21/10.5	2.1	82/180.78
PCR4000LE			7.3	88/43 or less		40/20	4			28/14	2.8	96/211.64
PCR6000LE		170 to 250	10.6	64 or less		60/30	6			42/21	4.2	140/308.65
	3Φ3wire*	Line voltage 170 to 250		38 or less								
	3Φ4wire*	Line voltage 324 to 440 (Phase voltage 187 to 254)		21 or less								
PCR9000LE	3Φ3wire	Line voltage 170 to 250	15.7	55 or less		90/45	9			63/31.5	6.3	190/418.88
	3Φ4wire*	Line voltage 324 to 440 (Phase voltage 187 to 254)		30 or less								

* When the output phase voltage is between 1 V and 100 V (L range) or 2 V and 200 V (H range) and the load power factor is between 0.8 and 1. When the output phase voltage is between 100 V and 150 V (L range) or 200 V and 300 V (H range), the output current is reduced by the output phase voltage.When the load power factor is between 0 and 0.8, the output current is reduced by the load power factor. When the output frequency is between 1 Hz and 40 Hz, the output current is reduced by the output frequency. * Factory option

[NOTICE] To users of the PCR-L/LA Series

The PCR-LE Series is not compatible with the previous product, the PCR-L/LA Series. Consequently, it is not possible to upgrade a system if it includes a prior PCR-L/LA Series in the system. Also, in general, options cannot be used (with some exceptions.) Please consider this when planning your future system.
If you have any other questions, please contact our sales department for details.

KHA3000

Harmonic/Flicker Analyzer

Using this equipment alone, you can perform a series of processes involved in a compliance test from setting test conditions and running the test to monitoring the test status in real time, judging test results against limit values, and outputting result reports through without the use of a PC. Also, a test system can be set up with ease by combining KHA3000 with an AC power supply and a line impedance network (LIN40MA-PCR-L/ LIN3020JF). *For details, please refer to page 88.

Functions

● Wide range of output. DC output is also supported.

Item	Range
Voltage (AC) *1	1 V to 150 V (L range), 2 V to 300 V (H range)
Frequency	1 Hz to 999.9 Hz *2
Voltage (DC/AC+DC) *1	±1.4 V to ±212 V (L range), ±2.8 V to ±424 V (H range)

*1 : Settings available from 0 V.
*2 : The frequency is limited to the range from 1 Hz to 500.0 Hz when the 3P05-PCR-LE (500HzLMT) is installed in the PCR-LE series.
In addition, the system supports a DC output mode and AC + DC output mode. The system can be useful in a wider range of fields such as chemistry- and physics-related areas.

● Selectable response mode

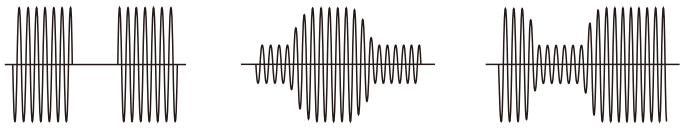
Allows to select a response mode for the internal amplifier system depending on the load condition and application.

Item	Application
High-speed response (FAST)*3	for requesting a rate of power rise/fall
Normal response (MEDIUM)	for testing various power supply environments
Highly stable response (SLOW)	for power supply for EMC testing sites

*3 : Excluding PCR6000LE, PCR9000LE, PCR6000LE2, PCR9000LE2, PCR12000LE2, PCR18000LE2,PCR27000LE2, three phase operation, parallel operation

● Power line abnormality simulation

In AC mode, it is possible to simulate the power line abnormalities by setting the output of the PCR-LE series system to the state of a power outage, voltage drop (dip), or voltage increase (pop). This allows the ability to test switching power supplies and electronic equipments.



power outage　voltage increase (pop)　voltage drop (dip)

● Various measuring functions

Output voltage/current RMS values, peak voltage/current, effective power/apparent power, average value voltage/current and power factor can be measured.
It is possible to analyze harmonics (up to 40 th order) of the output current.

PCR-LE/LE2 Series Options

■ Interface
IB05-PCR-LE (GPIB)
US05-PCR-LE (USB)
LN05-PCR-LE (LAN/LXI)
EX05-PCR-LE (Analog)*4
EX06-PCR-LE (Analog)*5

■ Dip Simulater
DSI1020
DSI3020

■ Line impedance network
LIN1020JF
LIN3020JF
OP01-LIN1020JF

■ Extension cable for control panel(2 m)
EC05-PCR

■ Sequence Creation Software
SD011-PCR-LE(Wavy for PCR-LE)

■ Avionics test software
SD012-PCR-LE/WE

■ Remote control software for the Windows tablet
SD021-PCR-LE/WE

■ Quick Immunity Sequencer 2
SD009-PCR-LE/WE

"Quick Immunity Sequencer 2" (model name: SD009-PCR-LE/WE) is an application software for immunity testing with the AC power supply PCR-LE series system, based on the power line disturbance standard (IEC61000-4 Series) for the immunity testing of the EMC standard. Not only can it be used for compliance testing based on the latest standards or for some types of preliminary testing, but the software can be also employed for advance checking in development phases and for immunity margin tests, because it allows extended testing conditions to be set as needed.

The latest standards for IEC61000-4 supported!

PCR-LE Series Options

■ Input power cable
AC5.5-3P3M-M4C(For PCR1000LE)
AC8-1P3M-M5C-3S(For PCR2000LE)
AC14-1P3M-M8C-3S
(For PCR3000LE/PCR6000LE(1P2W input))
AC22-1P3M-M8C-3S(For PCR4000LE)
AC14-1P3M-M5C-4S
(For PCR6000LE(3P3W input)/PCR9000LE(3P3W input))
AC5.5-1P3M-M5C-5S
(For PCR6000LE(3P4W input)/PCR9000LE(3P4W input))

■ Extension cable for PD05S-PCR-LE
PC01-PCR-LE(1.3 m)
(For parallel operation)

■ Connecting cable (for 2P05,3P05)
CC01-PCR-LE (1.5 m)
CC02-PCR-LE (2.8 m)

■ Power signal cable
CC11-PCR-LE(1 m)
(For parallel operation)

■ Parallel Operation Driver *6
PD05M-PCR-LE
(for master unit operated in parallel)
PD05S-PCR-LE
(for slave unit operated in parallel)

■ Three-phase Driver
3P05-PCR-LE
3P05-PCR-LE (500 Hz LMT)

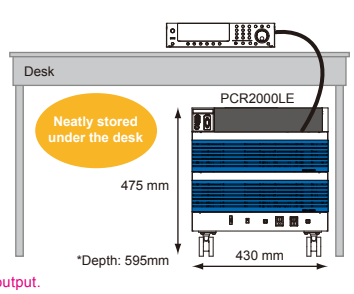
■ Single-phase
Three-wire Output Driver
2P05-PCR-LE

■ Power Linkage Cable (1 m)
LC01-PCR-LE

● Front panel serving as a remote control

The front panel is detachable. With the optional extension cable, the panel functions as a remote control.You can operate the PCR-LE unit installed under your work desk/work bench remotely from the front panel connected with the optional extension cable (EC05-PCR).

[Practical example]



*4 The input waveform is directly amplified and output.
*5 The voltage of the output alternating current can be changed based on the level input DC signal.
*6 PCR500LE and PCR1000LE and PCR6000LE2 and PCR9000LE2 and PCR12000LE2 and PCR18000LE2 and PCR27000LE2 can not be operated in parallel.

High-performance multifunctional AC Power Supplies

PCR-LE2 Series

LAN OPTION USB OPTION GPIB OPTION RS232C DRIVERS CE*1 LXI

*Refer to page 8

PCR6000LE2 PCR9000LE2 PCR27000LE2*2

*Capable of single-phase, single-phase three-wire*3,and three-phase output with a single unit. Convenient multiple output supports a versatile range of industrial devices.*

The PCR-LE2 Series is designed based on the PCR-LE Series which can switch between single-phase output, single-phase three-wire output, and three-phase output by switching from the front panel operation. It contains the same basic features and performance of the PCR-LE Series, and uses the same power unit as the PCR-LE Series. Use of this series is much easier than installing individual single-phase, single-phase three-wire, and three-phase systems, and allows more effective use of space. The PCR-LE2 Series are available in 5 models: 6 kVA, and 9 kVA, and 12 kVA, and 18 kVA and 27 kVA.

*1: PCR12000LE2, PCR18000LE2, PCR27000LE2 are excluded.
*2: The PCR12000LE2, PCR18000LE2, PCR27000LE2 requires for the installation work. Please consult with your local Kikusui distributor.
*3: The Output power with single-phase 3-wire limits 2/3 of the rated output.

Dimensions / Weight

PCR6000LE2: 430(16.93″)W X 944(37.17″)H X 550(21.65″)Dmm(inch) /140kg(308.65lbs)
PCR9000LE2: 430(16.93″)W X 1325(52.17″)H X 550(21.65″)Dmm(inch) /190kg(418.88 lbs)
PCR12000LE2: 1485(58.46″)W X 790(31.10″)H X 835(32.87″)Dmm(inch) /350kg(771.61 lbs)
PCR18000LE2: 1485(58.46″)W X 1045(41.14″)H X 835(32.87″)Dmm(inch) /480kg(1058.21 lbs)
PCR27000LE2: 1485(58.46″)W X 1425(56.10″)H X 835(32.87″)Dmm(inch) /630kg(1388.91 lbs)

Accessories

Setup Guide, Quick Reference (1 each for English and Japanese), CD-R(Contains the User's Manual and the Communication Interface Manual), Safety information

Features

- High-quality/high-stability output with a high-speed linear amp
- Capable of various power line abnormality simulations and sequence operation
- Single-phase 6 kVA to 27 kVA, Capable of the Single-phase output, Single-phase 3-wire output, and Three-phase output.
- Equipped with various measuring functions
- Features a full range of measuring functions and supports AC, DC, and AC + DC Outputs
- Detachable front panel
- Eco-friendly function equipped

Specifications

Model	Input rating (AC rms values)				AC mode output rating (AC rms values)					DC mode output rating				Weight
	Phase	Voltage	Apparent power	Current	Phase	Phase voltage	Max.Current*1	Power capacity	Frequency	Phase	Phase voltage	Max.Current*2	Power capacity	kg/lb
		V	Approx. kVA	A		V	A	kVA	Hz		V	A	kW	
PCR6000LE2	1Φ	170 to 250	10.6	64 or less	1Φ	1 to 150/ 2 to 300 (L/H output range) (Voltage setting range) 0 to 152.5/ 0 to 305.0	60/30	6	1 to 999.9 ★	1Φ	±1.4 to ±212/ ±2.8 to ±424 (L/H output range) (Voltage setting range) -215.5 to +215.5/ -431.0 to +431.0	42/21	4.2	140/ 308.65
	3Φ3wire*	Line voltage 170 to 250		38 or less	3Φ		20/10			3Φ		14/7		
	3Φ4wire*	Line voltage 324 to 440 (Phase voltage 187 to 254)		21 or less	1Φ3wire			4		1Φ3wire			2.8	
PCR9000LE2	3Φ3wire	Line voltage 170 to 250	15.7	55 or less	1Φ		90/45	9		1Φ		63/31.5	6.3	190/ 418.88
	3Φ4wire*	Line voltage 324 to 440 (Phase voltage 187 to 254)		30 or less	3Φ		30/15			3Φ		21/10.5		
					1Φ3wire			6		1Φ3wire			4.2	
PCR12000LE2	3Φ3wire	Line voltage 170 to 250	23	75 or less	1Φ		120/60	12		1Φ		84/42	8.4	350/ 771.61
	3Φ4wire*	Line voltage 324 to 440 (Phase voltage 187 to 254)		39 or less	3Φ		40/20			3Φ		28/14		
					1Φ3wire			8		1Φ3wire			5.6	
PCR18000LE2	3Φ3wire	Line voltage 170 to 250	33	111 or less	1Φ		180/90	18		1Φ		126/63	12.6	480/ 1058.21
	3Φ4wire*	Line voltage 324 to 440 (Phase voltage 187 to 254)		59 or less	3Φ		60/30			3Φ		42/21		
					1Φ3wire			12		1Φ3wire			8.4	
PCR27000LE2	3Φ3wire	Line voltage 170 to 250	48	165 or less	1Φ		270/135	27		1Φ		189/94.5	18.9	630/ 1388.91
	3Φ4wire*	Line voltage 324 to 440 (Phase voltage 187 to 254)		91 or less	3Φ		90/45			3Φ		63/31.5		
					1Φ3wire			18		1Φ3wire			12.6	

*1 When the output phase voltage is between 1 V and 100 V (L range) or 2 V and 200 V (H range) and the load power factor is between 0.8 and 1. When the output phase voltage is between 100 V and 150 V (L range) or 200 V and 300 V (H range), the output current is reduced by the output phase voltage.
When the load power factor is between 0 and 0.8, the output current is reduced by the load power factor.
When the output frequency is between 1 Hz and 40 Hz, the output current is reduced by the output frequency.

*2 When the output phase voltage is between 100 V and 212 V (L range) or 200 V and 424 V (H range), the output current is reduced by the output phase voltage.
★The 500Hz Limit Model is available.The PCR-LE Series offers the type on each model that limits the maximum output frequency up to 500 Hz.
* Factory option

PCR-LE2 Series Options

■ Input power cable

AC5.5-1P3M-M5C-5S
(For PCR6000LE2(3P4W input)/PCR9000LE2(3P4W input))

AC14-1P3M-M8C-3S(For PCR6000LE2(1P2W input))

AC14-1P3M-M5C-4S
(For PCR6000LE2(3P3W input)/PCR9000LE2(3P3W input))

■ Other options

- Please refer to PCR-LE/LE2 option section at 50 page.
- Fixing PCR6000LE/PCR9000LE/PCR6000LE2/PCR9000LE2 to the floor by L-shaped brackets is required.

IEC Dip · Simulator

DSI Series [DSI1020/DSI3020]

USB OPTION GPIB OPTION RS232C

DSI3020▶

The DSI3020 supports the voltage dip testing of 230 V and 400 V line-voltage systems required for the three-phase three-wire, and the three-phase four-wire.

For the Voltage dips, short interruptions and voltage variations immunity test system, complying with IEC61000-4-11 (2004)

The DSI Series is an option unit used to configure the test system complying with "Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests" as defined in the IEC61000-4-11 (2004) standard. It can be used in combination with the Kikusui AC power supplies (PCR-LE/LE2 series). It meets the test requirement of: high-speed voltage switching (rise time: 1 µs to 5µs), voltage dips (0 %, 40 %, 70 %, and 80 %), and phase-voltage and line-voltage tests.

*Quick Immunity Sequencer (model: SD009-PCR-LE/WE) is required.

◆ **DSI1020 : Applied to the Single-phase two-wire system**
◆ **DSI3020 : Applied to the Single-phase two-wire, Single-phase three-wire,Three-phase three-wire, and Three-phase four-wire system.**

Features

■ Fast Votage rise/fall time (1 µs to 5 µs)
■ Applied to the voltage dips (0 %, 40 %, 70 %, and 80 %)
■ Applied to the Line Voltage-dip* and the Phase Voltage-dip
■ Maximum Line Input voltage 500 V (rms)

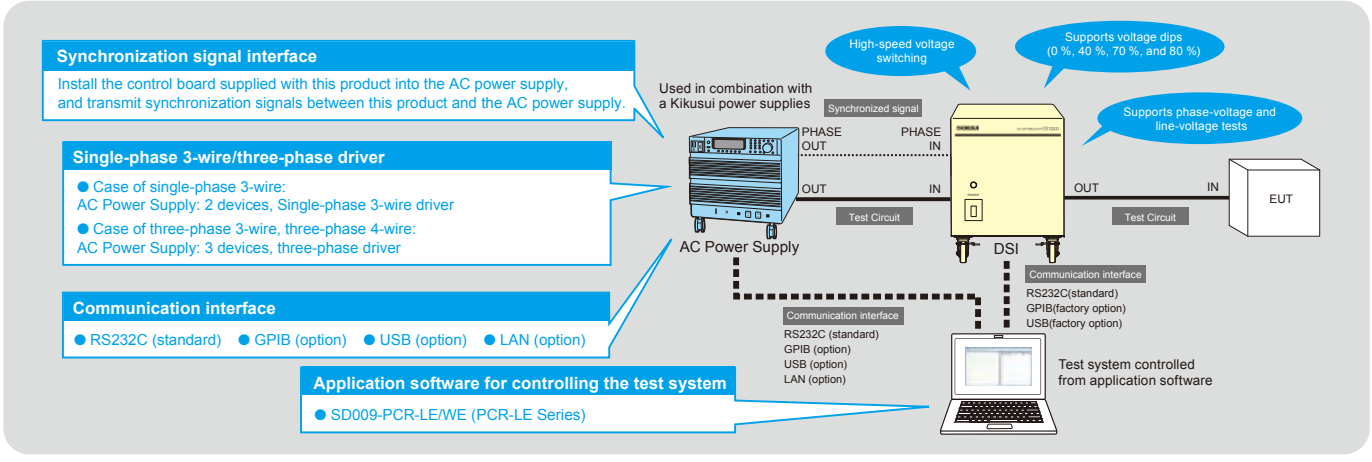
*The Line Voltage-dip applied to only the "DSI3020".

Model	Maximum current (per phase)	Wiring configuration		DIP level	Complied standard	Remarks
		Single phase	Three phase			
DSI1020*	16 A	✔		0/40/70/80 %	IEC61000-4-11(2004)	For Single Phase only
DSI3020*	16 A	✔	✔	0/40/70/80 %	IEC61000-4-11(2004)	For Single Phase or Three Phase

* Excluding the PCR500LE and PCR1000LE, since those model do not have enough output capacity.

Voltage dips, short interruptions and voltage variations immunity test system

* Figure is for reference only. It may differ from an actual product.

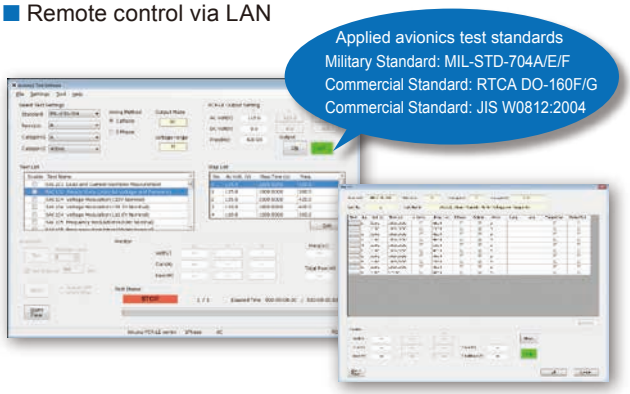


To maximize the features and performance of the PCR-LE/LE2 Series, various types of software are available depending on the testing applications.

For Avionics Test Application
SD012-PCR-LE/WE
Avionics Test Softwere

Supporting to the compliance testing of the avionics test standard.
The test pattern can be conducted from the Library.

- Easy configuration - just select standard from library
- Test step editing and saving - convenient for development and evaluation required with marginal testing
- Test condition reporting function - enables test history logging
- Remote control via LAN

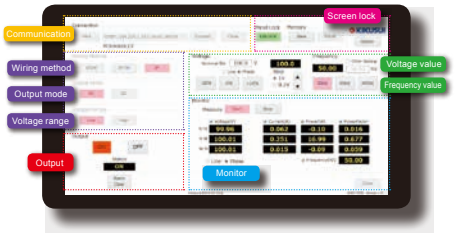


Remote control software for the Windows tablet
SD021-PCR-LE/WE
RMT CONT SOFTWARE FOR PCR-LE

The Windows tablet can be used as a remote controller !

The SD021-PCR-LE/WE is software that can control the PCR-LE/LE2 Series. It is capable of changing the setting condition of the "wiring method", "output mode", "voltage range", "voltage value", and "frequency value". These settings changed by the remote controller can be saved and recalled. Moreover, it can display the measurement value of the AC power supply. The remote operation and control of the AC power supply from the distance can be easily realized.

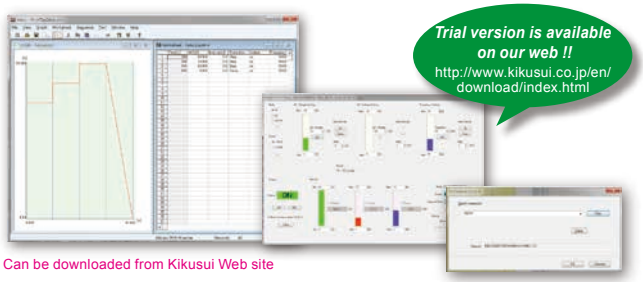
Screen display (main screen)



● Operating Environment : Intel Core 2 or later / Windows 8.1 / Memory 4GB / Storage 128GB / Display resolution 1366 x 768 or higher / USB port
*The LAN cable, LAN adaptor (micro USB to the wired LAN), the optional LAN board (LN05-PCR-LE) are required.

Sequence creation software
SD011-PCR-LE
Wavy for PCR-LE

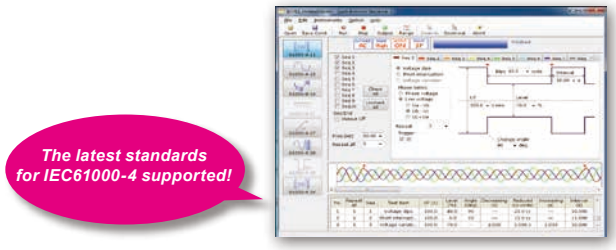
- It makes it easier to create or edit the test condition file required for the sequence operation.
- By using the storage function of test condition data file, it enables you to manage the test condition of the standard routine test.
- The progress of execution sequence will be displayed on the "practical dialogue" with the setting value and the cursor.
- It is possible to observe the intuitionistic output through by the "monitor graph" that plots the ongoing monitor value.
- You can save the acquired monitor data as a test result.
- Newly added features of "Sequence Pre-view Dialog" enables you to confirm the waveform before executing the sequence operation.



Can be downloaded from Kikusui Web site

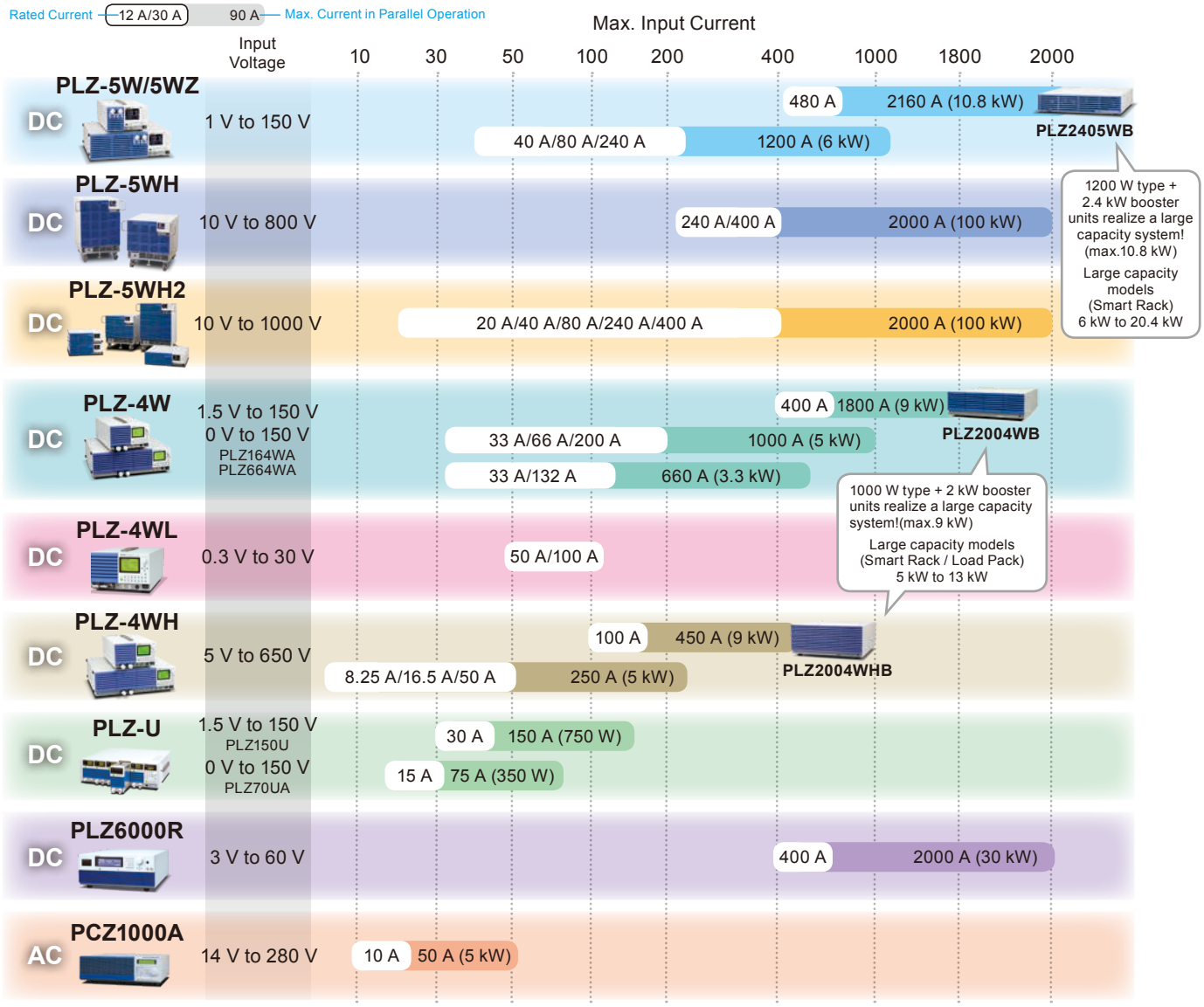
Power Line Disturbance Immunity Testing Software
SD009-PCR-LE/WE
Quick Immunity Sequencer2

- Capable of performing the compliance testing applied to the IEC6100-4-11, 4-13, 4-14, 4-17, 4-27, 4-28, 4-29, 4-34 or to perform preliminary test before the standard testing.
- Applied to Single-phase/ Single-phase three-wire/ Three-phase and the DC input power.
- Not only for the compliance standard testing, it can be also employed for advance checking in development phases and for margin tests.
- Sequence chain (up to 10 sequences) features to improve the test efficiency
- Waveform preview provides a general idea of the output waveform without having an oscilloscope
- The setting condition file and the test result file can be saved in txt or csv format.



ELECTRONIC LOAD SELECTION GUIDE

Series		PLZ-5W/5WZ	PLZ-5WH	PLZ-5WH2	PLZ-4W	PLZ-4WL	PLZ-4WH	PLZ-U	PLZ6000R	PCZ1000A
Line up		4 models	2 models	5 models	6 models	2 models	4 models	4 models	1 model	1 model
Features		Multi Functional	High Voltage	High Voltage	Multi Functional	High Speed	High Voltage	Multi Channel	Regenerative	Variable Crest Factor
Input		DC	DC	DC	DC	DC	DC	DC	DC	AC
Mode	CC	✔	✔	✔	✔	✔	✔	✔	✔	✔
	CC+CV	✔	✔	✔	✔	✔	✔	✔	✔	
	CR	✔	✔	✔	✔	✔	✔	✔	✔	✔
	CR+CV	✔	✔	✔	✔	✔	✔	✔	✔	
	CV	✔	✔	✔	✔	✔	✔	✔	✔	
	CP	✔	✔	✔	✔	✔	✔		✔	✔
Input rating (Max.)		200 W/400 W/ 1.2 kW	12 kW/20 kW	1 kW/2 kW/ 4 kW/12 kW/ 20 kW	165 W/330 W/ 660 W/1 kW	165 W/330 W	165 W/330 W/ 1 kW	75 W/150 W	6 kW	1 kW
		150 V	800 V	1000 V	150 V	30 V	650 V	150 V	60 V	280 V
		240 A	400 A	400 A	200 A	100 A	50 A	30 A	400 A	10 A
Zero Voltage Input model		–	–	–	Available	–	–	Available	–	–
GPIB		Option	Option	Option	✔	✔	✔	✔	✔	–
RS232C		✔	✔	✔	✔	✔	✔	✔	✔	✔
USB		✔	✔	✔	✔	✔	✔	–	✔	–
LAN		✔	✔	✔	–	–	–	–	–	–



* Large capacity models(SR/LP Series) are also available on both the PLZ-5W and PLZ-4W, PLZ-4WH series. (See page 58, 69.)

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-5W/5WZ Series

GPIB (OPTION) USB RS232C LAN DRIVERS CE LXI

*Refer to page 8

PLZ205W
PLZ405W

PLZ1205W

High-speed response, advanced communications, large-scale system capability

The PLZ-5W Series high performance electronic load is the successor to the highly respected PLZ-4W series, whilst still retaining the same high specification and build quality. Advances include a high visibility color display and low voltage operation from a minimum of 1 V to a maximum of 150 V. Programmable profiles of voltage/current can be applied (using the new ARB function, as used in LED/solar testing) in addition to the inherited 6 modes of operation: Constant Current, Constant Resistance, Constant Voltage, Constant Power, Constant Current + Constant Voltage, Constant Resistance + Constant Voltage. Equipped with a high-speed response feature boasting a maximum slew rate of 60 A/µs (PLZ1205W) and a minimum setting resolution of 10 µA (PLZ205W). Additional features of the PLZ-5W series include: Soft-start function, variable slew rate, selectable response (CV/CR mode), switching function, ABC preset memory, 20 user-defined set-up configurations, and a sequence operation function. The advanced high-speed response makes the PLZ-5W ideal for the development and testing of today's modern power supplies that require variable high-speed current changes. This advantage extends to the testing of current clamps/ transducers. The PLZ-5W Series is available in 4 standard models which can be incrementally extended by adding additional booster units (PLZ2405W) to achieve a maximum of 10.8 kW / 2160 A DC electronic load.

Dimensions

PLZ205W/PLZ405W: 214.5(8.45″)W × 124(4.88″)H × 400(15.75″)Dmm(inch)
PLZ1205W: 429.5(16.91″)W × 128(5.04″)H × 400(15.75″)Dmm(inch)

Accessories

Power cord (Cord length: Approx. 2.5 m), Rear-panel load input terminal cover, Load input terminal screw set (2 sets), Screws for the rear-panel load input terminal cover (2 pcs.), Front-panel load input terminal cover, Front-panel load input knob set, External control connector kit, Setup Guide, CD-ROM, Quick Reference(Japanese 1 sheet, English 1 sheet), Safety Information

Features

- Operation voltage: 1 V to 150 V (from 0.05 V)
- High speed slew rate: 60 A/µs
- Arbitrary I-V characteristics: Installed “ARB mode”
- Parallel operation feature: The total current and power capacities can be increased to the maximum of 10.8 kW (2160 A) by connecting the booster units.
- New high visibility color display.
- LAN(LXI compliant)/RS232C/USB are standard interface. External analog control. *GPIB option.
- Improved sequence feature (Maximum 10000 steps)
- Setup memory can be saved to or loaded from a USB flash drive.

Specifications

Model	Rating			Constant current mode				Constant voltage mode			
	Operating voltage	Current	Power	Operating range			Ripple	Operating range		Resolution	
	V	A	W	Range H (A)	Range M (A)	Range L (A)	mA rms	Range H (V)	Range L (V)	Range H (mV)	Range L (mV)
PLZ205W	1 to 150	40	200	0 to 42	0 to 4.2	0 to 0.42	4	0 to 157.5	0 to 15.75	5	0.5
PLZ405W		80	400	0 to 84	0 to 8.4	0 to 0.84	8				
PLZ1205W		240	1200	0 to 252	0 to 25.2	0 to 2.52	24				

Model	Constant resistance mode			Constant power mode			Weight	Dimensions	Power consumption
	Operating range			Operating range			kg/lb	Type	Approx. VA
	Range H (S)	Range M (S)	Range L (mS)	Range H (W)	Range M (W)	Range L (W)			
PLZ205W	42 to 0	4.2 to 0	420 to 0	0 to 210	0 to 21	0 to 2.1	7/15.4	I	50
PLZ405W	84 to 0	8.4 to 0	840 to 0	0 to 420	0 to 42	0 to 4.2	7.5/16.5	I	50
PLZ1205W	252 to 0	25.2 to 0	2520 to 0	0 to 1260	0 to 126	0 to 12.6	14/30.9	II	85

Common Specifications

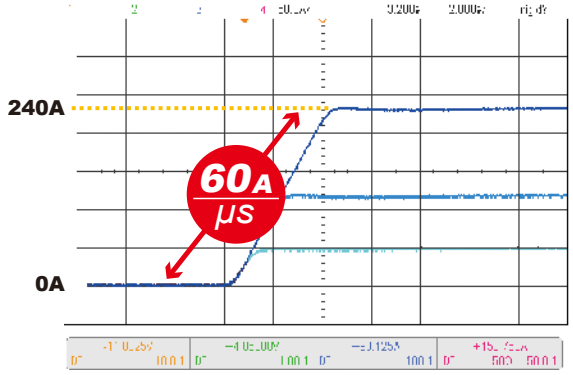
Switching operation ····· Operation mode: CC and CR
Frequency range: 1.0 Hz to 100.0 kHz
Duty cycle setting range: 1% to 99%

Input voltage ····· 100 Vac to 240 Vac (90 Vac to 250 Vac) single phase

Functions

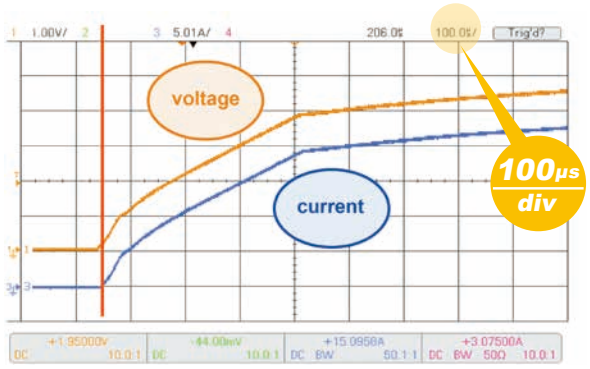
■ Maximum slew rate of 60 A/μs

Achieving a rise time of 4 μS to reach the rated current of the electronic load. Power supply evaluation demands a fast transient response which the PLZ-5W series achieves with ease.



■ High speed voltage tracking characteristics

High speed voltage tracking characteristic in CR mode is perfect for applications such as startup tests for power supplies.



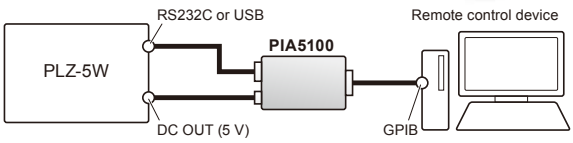
Options

■ GPIB converter

PIA5100

This converter converts RS232C or USB of the PLZ-5W to GPIB, enabling connection of a remote controller using GPIB. [Accessories: Power cord set, Magnetic sheet]

[Connection example]



*For the details, please refer to page 42.

■ Parallel operation signal cable kit

PC01-PLZ-5W (Cable length: Approx. 30 cm)

■ Sequence creation software

SD023-PLZ-5W (Wavy for PLZ-5W)

■ Booster unit PLZ2405WB*

Connecting up to 4 booster (PLZ2405WB) units with the master (PLZ1205W) increases the maximum system capability to 10.8 kW 2160 A. The optional parallel cable (PC01-PLZ-5W) is required to connect between the master and slave/booster units.

■ Specifications

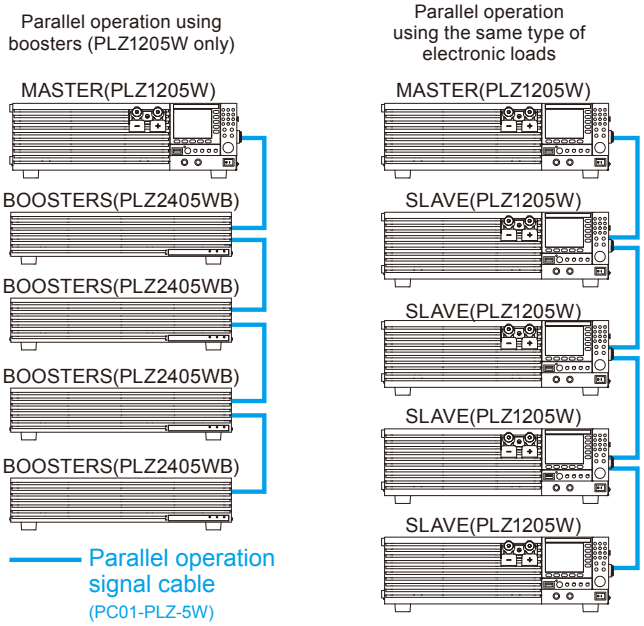
Operating voltage	1 Vdc to 150 Vdc
Current	480 A
Power	2400 W
Input voltage	100 Vac to 240 Vac (90 Vac to 250 Vac) single-phase
Power consumption	95 VAmax
Dimensions	430(16.93″)W×86(3.39″)H×450(17.72″)Dmm (inch)
Weight	approx. 15 kg (33.07 lb)

*PLZ2405WB is a dedicated booster for PLZ1205W.
It cannot be used with any other model.

■ Parallel operation

Without using boosters, you can connect up to five units of the same model in parallel, including the master unit (max. 6 kW, 1200 A).
In the parallel connection configuration, one control master operates with one or more slave units, enabling you to control the entire system and view its data on the master unit's panel.
To connect the units requires the use of as many optional parallel cables (PC01-PLZ-5W) as the number of units to be connected.

*The PLZ2405WB (Booster) comes with 1 pc. of parallel operation cable (PC01-PLZ-5W).



* Do not stack three or more loads on top of each other.
You can stack loads (booster and master unit), but for safety reasons, only stack up to two units. If you want to use two or more boosters, we recommend you to rack mount them.

PLZ-5WZ Series Models with Impedance Measurement Function

Impedance measurement function has been added as a factory option for the electronic load PLZ-5W series.
Impedance measurement can be easily performed without creating a program by simply using the attached application software Imp. Meas. for PLZ-5WZ.

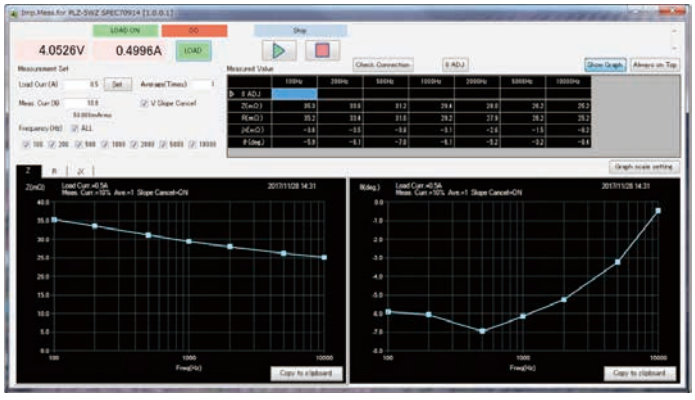
Features

- An impedance measurement system can be easily created with a single PLZ-5WZ unit and dedicated impedance measurement software.
- Real-time impedance values of the DUT can be obtained during discharge.
- R, jX, 0 and Z measurements available.
- AC frequency from 100 Hz - 10 kHz (seven fixed settings) and signal levels are programmable.
- Voltage slope correction feature that minimizes the effect of voltage slope due to discharge.
- Improved accuracy during minute impedance measurement with the zero adjustment function.
- Measurement results and graphs from the application software can be copied directly to Excel.

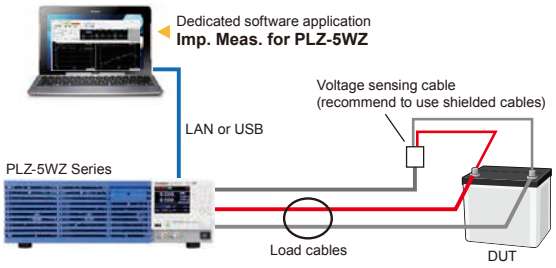
PLZ-5WZ Series Lineup (SPEC21192)

Model	Maximum operating current (A)	Operating voltage (V)	Power (W)
PLZ205WZ	40	1 to 150	200
PLZ405WZ	80	1 to 150	400
PLZ1205WZ	240	1 to 150	1200

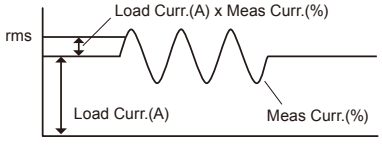
Application software Imp. Meas. for PLZ-5WZ (accessory)



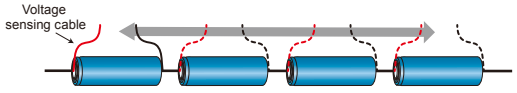
System Configuration (example)



● Measurement condition diagram



● Impedance measurement for each single cell is also possible



■ Measurement functions

Item	Details	Conditions & remarks
Measurement AC frequency	100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz	Seven fixed settings
Measurement AC current (Meas Curr.)	0.1 % to 10 % of the DC load current (Load Curr.)	Set as a percentage
Measurement time	50ms to 5s	Depends on the measurement AC frequency.
Measurement items	R, X, |Z|, θ.	θ is calculated from R and X.
Measurement average	Averages 1 to 16 measured values.	Function available when using application
Zero adjustment (0 ADJ)	Zero adjustment on the DUT voltage sensing end	Function available when using application
Voltage slope correction	Eliminates the effect that the slope of the DUT voltage caused by discharge has on measurements	Complete elimination is not possible if the slope is nonlinear
Measurement method	2-phase lock-in amplifier method	Based on digital computation.
Operating environment	Windows7/Windows10 (32 bit/64 bit)	

■ Measurement accuracy

Conditions ■ Ambient temperature: 18°C to 28°C ■ DUT: Reference resistance ■ Bias power supply: 12 V 54 Ah lead battery
■ Measurement AC current: Depends on DUT impedance (refer to the following table).

● Voltage range at L range (15 V)

Percentage of ±Z readout value		Measurement AC frequency		
DUT impedance	Measurement AC current	100 Hz, 200 Hz, 500 Hz	1 kHz, 2 kHz	5 kHz, 10 kHz
1.0 mΩ to 9.9 mΩ	500 mArms or more	±(5 % of reading+0.5 mΩ)	±(5 % of reading+0.5 mΩ)	-
10.0 mΩ to 99.9 mΩ	250 mArms or more	±(5 % of reading+0.5 mΩ)	±(5 % of reading+0.5 mΩ)	-
100.0 mΩ to 1000.0 mΩ	150 mArms or more	±(2 % of reading+0.5 mΩ)	±(3 % of reading+0.5 mΩ)	-

● Voltage range at H range (150 V)

Percentage of ±Z readout value		Measurement AC frequency		
DUT impedance	Measurement AC current	100 Hz, 200 Hz, 500 Hz	1 kHz, 2 kHz	5 kHz, 10 kHz
1.0 mΩ to 9.9 mΩ	2 Arms or more	±(5 % of reading+0.5 mΩ)	±(5 % of reading+0.5 mΩ)	-
10.0 mΩ to 99.9 mΩ	500 mArms or more	±(5 % of reading+0.5 mΩ)	±(5 % of reading+0.5 mΩ)	-
100.0 mΩ to 1000.0 mΩ	250 mArms or more	±(3 % of reading+0.5 mΩ)	±(4 % of reading+0.5 mΩ)	-

* Accuracy of measurements outside the measurement range, L range current, and shaded portion is not guaranteed.

* θ is calculated from R and X by the application software.

* Specifications not listed above are in accordance with PLZ-5W Series product specifications.

* Please contact our sales department for firmware update.

● Large Capacity Model (Smart Rack) <PLZ-5W SR Series> Lineup

Please refer to page 55 to 56 for product detail.

Features

A compact, large scale system, SR (Smart Rack) Series is also available. The input power is available in 6 kW, 10.8 kW, 15.6 kW, and 20.4 kW. The maximum input current is 2160 A. (*1200 A for PLZ6005W)

- The system offers from 6 kW to 20.4 kW, in 4 models.
- Assembled with exclusive components based on optimization design concept.
- Delivered systems are fully assembled and tested, so immediate operation is possible.
- Smallest in class.
- AC Input 90 V to 250 V Auto select. No special wiring is required.
- Range switching function allows to guarantees the specification even for the smallest input. (Perfromance test Data is included with the system as standard document)
- LAN/USB/RS232C as standard interface. *GPIB option
- Capable of operation using the Sequence Creation software “Wavy”.
- The Load input terminal is designed on the Safety-Comes-First concept. (protection against electric shocks)
- Load cable for large current is available.

PLZ-5W SR Series Lineup

Model	PLZ6005W SR	PLZ10005W SR	PLZ15005W SR	PLZ20005W SR
Maximum input rating	6 kW / 1200 A	10.8 kW / 2160 A	15.6 kW / 2160 A	20.4 kW / 2160 A
				

* Definition of Series Name: SR (Smart Rack)

Options

■ High Current Load Wire *Solderless terminals on both ends.

Model	DC14-2P3M-M12M8	DC38-2P3M-M12M8	DC80-2P3M-M12M8	DC80-2P3M-M12M12	DC150-2P3M-M12M12	DC150-4P3M-M12M12	DC600-2P3M-M12M12
Maximum Allowable voltage	650 V						150 V
Maximum Allowable current	50 A	100 A	200 A	200 A	300 A	500 A	1000 A
Terminal	M12/M8	M12/M8	M12/M8	M12/M12	M12/M12	M12/M12	M12/M12
Nominal Cross-Sectional Area	14 mm² (Equivalent of AWG 5)	38 mm² (Equivalent of AWG 1)	80 mm² (Equivalent of AWG 3/0)	80 mm² (Equivalent of AWG 3/0)	150 mm² (Equivalent of AWG 6/0)	150 mm² (Equivalent of AWG 6/0)	600 mm²
Length (m(inch))/ Weight *Per cable	Approx.3 (11,81") / Approx.0.5 kg(1.10 lbs)	Approx.3 (11,81") / Approx1.4 kg (3.09 lbs)	Approx.3 (11,81") / Approx.2.8 kg (6.17 lbs)	Approx.3 (11,81") / Approx.2.8 kg (6.17 lbs)	Approx.3 (11,81") / Approx.5 kg (11.02 lbs)	Approx.3 (11,81") / Approx.5 kg (11.02 lbs)	Approx.3 (11,81") / Approx.20 kg (44.09 lbs)
Exterior design						 (4 sets)	

Dimensions

PLZ6005W SR	432.6(17.03″)W×385.6(15.18″)H×640(25.20″)Dmm(inch)	PLZ15005W SR	432.6(17.03″)W×748.4(29.46″)H×640(25.20″)Dmm(inch)
PLZ10005W SR	432.6(17.03″)W×567(22.32)H×640(25.20″)Dmm (inch)	PLZ20005W SR	432.6(17.03″)W×929.8(36.61″)H×640(25.20″)Dmm(inch)

Specifications

Model	Rating			Constant current mode (CC)				Constant voltage mode (CV)			
	Operating voltage	Current	Power	Operating range			Ripple	Operating range		Resolution	
	V	A	W	H range (A)	M range (A)	L range (A)	mArms*	H range (V)	L range (V)	H range (mV)	L range (mV)
PLZ6005W SR	1 to 150	1200	6000	0 to 1260	0 to 126	0 to 12.6	120	0 to 157.50	0 to 15.750	5	0.5
PLZ10005W SR		2160	10800	0 to 2268	0 to 226.8	0 to 22.68	216				
PLZ15005W SR			15600	0 to 3276	0 to 327.6	0 to 32.76	312				
PLZ20005W SR			20400	0 to 4284	0 to 428.4	0 to 42.84	408				

Model	Constant resistance mode (CR)			Constant power mode (CP)			Weight	Power consumption
	Operating range			Operating range			Approx.	Approx.
	H range (S)	M range (S)	L range (S)	H range (W)	M range (W)	L range (W)	kg/lb	VA
PLZ6005W SR	1260 to 0	126 to 0	12.6 to 0	0 to 6300	0 to 630	0 to 63.0	82/181	275
PLZ10005W SR	2268 to 0	226.8 to 0	22.68 to 0	0 to 11340	0 to 1134	0 to 113.4	120/265	465
PLZ15005W SR	3276 to 0	327.6 to 0	32.76 to 0	0 to 16380	0 to 1638	0 to 163.8	160/353	655
PLZ20005W SR	4284 to 0	428.4 to 0	42.84 to 0	0 to 21420	0 to 2142	0 to 214.2	200/441	855

* Measurement frequency bandwidth: 10 Hz to 1 MHz At measurement current of 100 A

Multifunctional Electronic Load (CC/CV/CR/CP) * While Supplies Last

PLZ-5WH Series

GPIB OPTION | USB | RS232C | LAN | DRIVERS | CE | LXI

*Refer to page 8

PLZ20005WH

PLZ12005WH

Maximum operating voltage 800 V. Ideal for high capacity power supply and rechargeable battery evaluation!

The PLZ-5WH high power DC electronic load series is where durable, reliable ingenuity meets multifunctional, high power design. The highly compact, power dense design of the PLZ-5WH series allows for up to 20 kW in a single unit. Load simulation can be achieved fast and efficiently with the PLZ-5WH high speed current control circuits. Accurate current measures can be made with extremely high setting resolution, with a color LCD interface for maximum visibility. LAN (LXI), USB, and RS232C digital interfaces have been included for simple integration into any system.

Dimensions

PLZ12005WH: 429.8(16.9″)W×396.2(15.6″)H×550(21.7″)Dmm(inch)
PLZ20005WH: 429.8(16.9″)W×573.5(22.6″)H×550(21.7″)Dmm(inch)

Accessories

Power cord (length:2.5 m), Load input terminal cover, Load input terminal screw set (2 sets), Screws for the load input terminal cover (2 pcs.), External control connector kit, Safety terminal adapter TL41 (red 1 set, black 1set), Parallel operation signal cable kit (Cable length:Approx. 1 m), Heavy object warning label, Safety Information, Setup Guide, Quick Reference (English/Japanese, 1 sheet each), CD-ROM

Features

- Operating voltage from 10 V - 800 V.
  Minimum operating voltage required for current output is 1.5 V.
- 20 kW capacity in a single, compact unit (PLZ20005WH)
- Parallel operation up to five units (Maximum 100 kW, 2000 A)
- Synchronization: Load on/off control and sequence execution can be synchronized among multiple units.
- Data logging function:
  The most recent measurements (current, voltage, power) are shown on display and can be stored in internal memory.
- Cutoff function: The load cutoff can be set once the specified time, voltage drop, integrated current, or integrated power has been reached.
- LAN (LXI Compliant)/USB/RS232C standard interface
  *GPIB factory option available

Specifications

Model	Rating			Constant current (CC) mode			Constant voltage (CV) mode		
	Operating voltage	Current	Power	Operating range	Setting range	Resolution	Operating range	Setting range	Resolution
	V	A	W	A	A	mA	V	V	mV
PLZ12005WH	10 to 800	240	12000	0 to 240	0 to 242.400	5	10 to 800	0 to 808.00	20
PLZ20005WH		400	20000	0 to 400	0 to 404.00	10			

Model	Constant resistance (CR) mode				Constant power (CP) mode			Weight	Power consumption
	Operating range *1		Setting range		Operating range	Setting range	Resolution	kg/lb	Approx. VA
	H range	L range	H range	L range	W	W	W		
PLZ12005WH	6000 mS to 0 S	60 mS to 0 S	6060.0 mS to 0 S	60.600 mS to 0 S	0 to 12000	0 to 12120	0.5	64/141.1	740
PLZ20005WH	10 S to 0 S	100 mS to 0 S	10.1000 S to 0 S	101.000 mS to 0 S	0 to 20000	0 to 20200	0.5	93/205	

*1. Conductance [S] = input current [A]/input voltage [V] = 1/resistance [Ω]

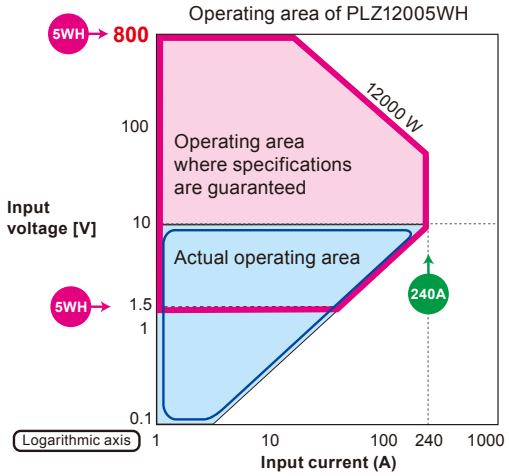
Common Specifications

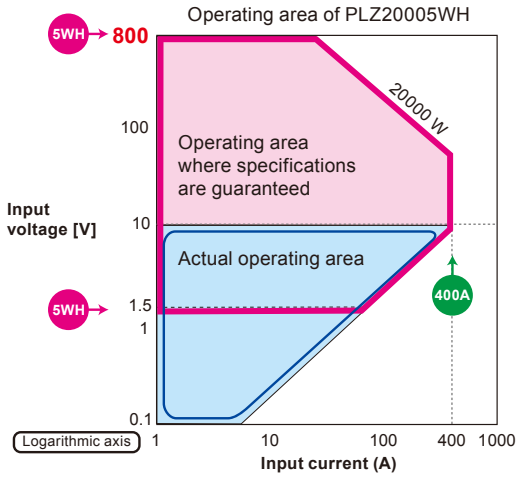
Input voltage range..... 100 Vac to 240 Vac (90 Vac to 250 Vac) single phase
Input frequency range ..... 47 Hz to 63 Hz
Arbitrary I-V characteristics (ARB) mode ..... Operating range: Three to 100 points of current values can be specified for the input voltage.
Linear interpolation is applied between specified points.
Response speed: 500 µs,1 ms,2 ms,5 ms,10 ms,20 ms,50 ms, 100 ms, or off
Pulse function ..... Operation mode: CC and CR
Frequency setting range: 1.0 Hz to 10.0 kHz
Sine function ..... Operation mode: CC
Frequency setting range: 1.0 Hz to 1 kHz, 2 kHz, 5 kHz, 10 kHz
Slew rate ..... Operation mode: CC
Soft start ..... Operation mode: CC
Time setting range: 500 µs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms, or off
Sequence function..... Operation mode: CC, CR, CV, CP
Maximum number of programs: 30 Maximum number of steps: 10000

Functions

■ Operating range up to 800 V

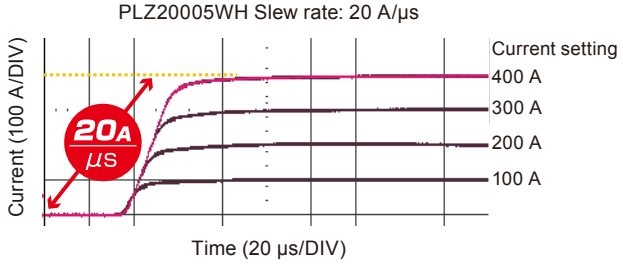
The rated power, current, voltage and minimum voltage can be seen in the following figure. Specifications are guaranteed at input voltages of 10 V and greater, but actual operation is available for input voltages as low as 1.5 V. However, this is outside of the operation area where specifications are not guaranteed.





■ Maximum slew rate of 20 A/μs

Current startup time of 20 A/μs until rated current achieved.
Compatible with high-speed transient response testing, which is becoming increasingly important for power source evaluation.
*For PLZ20005WH



■ Parallel operation

The PLZ12005WH/PLZ20005WH can be connected in master-slave paralel to increase the total current and power capacity. During parallel operation, one unit is selected as the master unit that controls all other PLZ12005WH/PLZ20005WH (slave) units connected in parallel. The master unit displays the total current and total power for all electronic loads connected in the system. The parallel operation signal cable is included with the device and is available upon request. Up to 4 slave units can be connected to the master unit with parallel operation signal cables that automatically select the master/slave status depending on the cable configuration. Standalone settings will return to normal when cables are removed and power is turned on, with no further configuration required.

Maximum current and power during parallel operation using the same model

Number of slaves	Maximum current / Maximum power	
	PLZ12005WH	PLZ20005WH
2	480 A / 24 kW	800 A / 40 kW
3	720 A / 36 kW	1200 A / 60 kW
4	960 A / 48 kW	1600 A / 80 kW
5	1200 A / 60 kW	2000 A / 100 kW

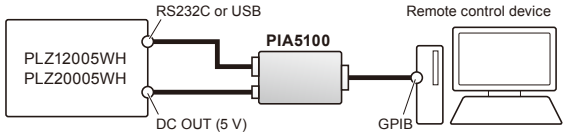
Options

■ GPIB converter

PIA5100

This converter converts RS232C or USB connection into GPIB, enabling remote control connection using GPIB as seen below.

[Connection example]



*For the details, please refer to page 42.

■ Parallel operation signal cable kit

PC02-PLZ-5W

This kit contains a signal cable for performing parallel operation on the PLZ12005WH/PLZ20005WH. Cable length: Approx. 1 m

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-5WH2 Series

GPIB (OPTION) USB RS232C LAN LXI DRIVERS CE

*Refer to page 8

NEW

Ideal for high-capacity power supply and rechargeable battery evaluation! Testing with hyper-realistic load simulation made possible!

The PLZ-5WH2 high-power DC electronic load series is where durable, reliable ingenuity meets multifunctional, high-power design. Providing 5 variety of power range line-ups, from a 1 kW bench-top style model, to a high-power model that can sink up to 20 kW of power in a single unit. You can easily select the applicable power range according to the load. Load simulation can be achieved faster than ever before thanks to the reliable, high-speed design of the PLZ-5WH2 current control circuits. Accurate current measures can be made with extremely high-setting resolution. A color LCD display allows for highly visible, user-friendly front-panel operation. RS232C, USB, and LAN digital inter faces are included as standard for simple integration into any system.

Dimensions

PLZ1005WH2: 429.5(16.91″)W×128(5.04″)H×400(15.75″)Dmm(inch)
PLZ2005WH2: 429.5(16.91″)W×128(5.04″)H×400(15.75″)Dmm(inch)
PLZ4005WH2: 429.5(16.91″)W×128(5.04″)H×500(19.69″)Dmm(inch)
PLZ12005WH2: 430(16.93″)W×396.2(15.6″)H×550(21.65)″Dmm(inch)
PLZ20005WH2: 430(16.93″)W×573.5(22.58″)H×550(21.65)″Dmm(inch)

Accessories

Common to all models: Power cord, Safety terminal adapter TL41 (red, black), External control connector kit, Safety Information, Setup Guide, Quick Reference (Japanese, English), CD-ROM

PLZ1005WH2, PLZ2005WH2, PLZ4005WH2: Rear-panel DC INPUT terminal cover, Screw set for rear-panel DC INPUT terminals, Screws for the rear-panel DC INPUT terminal cover, Front-panel DC INPUT terminal cover, Screws for the front-panel DC INPUT terminals, Heavy object warning label (PLZ4005WH2 only)

PLZ12005WH2, PLZ20005WH2: Rear-panel DC INPUT terminals cover, Screw set for rear-panel DC INPUT terminals, Rear-panel DC INPUT terminals cover screws, Heavy object warning label, Parallel operation signal cable kit [PC02-PLZ-5W]

Features

- Operating voltage: 10 V to 1000 V (Min. 1.5 V)
- 20 kW capacity in a single, compact unit (PLZ20005WH2)
- 100 kW/ 2000 A with parallel operation (Max. 5 units), connectable with different models.
- Synchronized operation
- Sequence function
- Arbitrary IV characteristic (ARB) mode
- User-friendly color LCD display
- Data-logging function: voltage/current/power/elapsed time/ integrated current/integrated power measurements. (Measurement display, programmable internal memory, stored as CSV format onto a USB.)
- Superposition of sinusoidal current (sine function, 1 Hz to 10 kHz)
- Cutoff function: The load can be turned off when the elapsed time, the voltage drop, the integrated current, or the integrated power reaches the specified value.
- LAN (LXI Compliant)/USB/RS232C standard interface *GPIB optional

Specifications

Model	Rating			Constant current (CC) mode			Constant voltage (CV) mode		
	Operating voltage	Current	Power	Operating range	Setting range	Resolution	Operating range	Setting range	Resolution
	V	A	W	A	A	A	V	V	V
PLZ1005WH2	10 to 1000	20	1000	0 to 20	0 to 20.2000	0.0005	10 to 1000	0 to 1010.00	0.02
PLZ2005WH2		40	2000	0 to 40	0 to 40.400	0.001			
PLZ4005WH2		80	4000	0 to 80	0 to 80.800	0.002			
PLZ12005WH2		240	12000	0 to 240	0 to 242.40	0.005			
PLZ20005WH2		400	20000	0 to 400	0 to 404.00	0.01			

Model	Constant resistance (CR) mode				Constant power (CP) mode			Weight	Power consumption
	Operating range *1		Setting range		Operating range	Setting range	Resolution		
	H range	L range	H range	L range	W	W	W	kg/lb	Approx. VA
PLZ1005WH2	500 mS to 0 S	5 mS to 0 S	505.00 mS to 0.00 S	5.05000 mS to 0.00000 S	0 to 1000	0 to 1010.00	0.02	13/28.7	70
PLZ2005WH2	1 S to 0 S	10 mS to 0 S	1.01000 S to 0.00000 S	10.1000 mS to 0.0000 S	0 to 2000	0 to 2020.00	0.05	16/35.3	90
PLZ4005WH2	2 S to 0 S	20 mS to 0 S	2.02000 S to 0.00000 S	20.2000 mS to 0.0000 S	0 to 4000	0 to 4040.0	0.1	20/44.1	150
PLZ12005WH2	6 S to 0 S	60 mS to 0 S	6.0600 S to 0.0000 S	60.600 mS to 0.000 S	0 to 12000	0 to 12.1200 k	0.0005 k (0.5)	64/141.1	360
PLZ20005WH2	10 S to 0 S	100 mS to 0 S	10.1000 S to 0.0000 S	101.000 mS to 0.000 S	0 to 20000	0 to 20.2000 k		93/205	590

*1. Conductance [S] = input current [A]/input voltage [V] = 1/resistance [Ω]

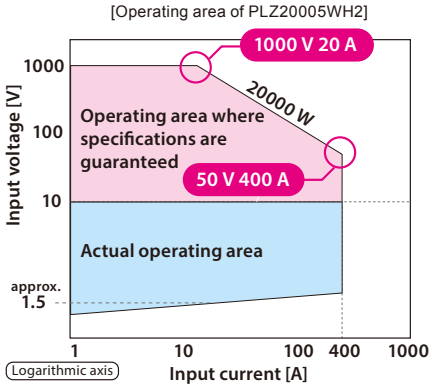
Common Specifications

Input voltage range..... 100 Vac to 240 Vac (90 Vac to 250 Vac) single phase
Input frequency range ..... 47 Hz to 63 Hz
Arbitrary I-V characteristics (ARB) mode ..... Operating range: Three to 100 points of current values can be specified for the input voltage. Linear interpolation is applied between specified points. Response speed: 500 µs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms, or off
Pulse function ..... Operation mode: CC and CR, Frequency setting range: 1.0 Hz to 10.0 kHz
Sine function ..... Operation mode: CC
Frequency setting range: 1 Hz to 1000 Hz, 2000 Hz, 5000 Hz, 10000 Hz
Slew rate ..... Operation mode: CC
Soft start ..... Operation mode: CC
Time setting range: 500 µs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms, or off
Sequence function..... Operation mode: CC, CR, CV, CP
Maximum number of programs: 30, Maximum number of steps: 10000

Functions

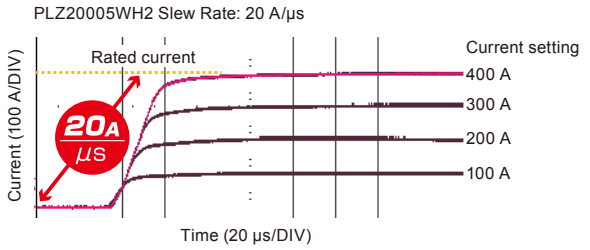
■ Wide ranging operation voltage up to 1000 V

Operating voltage ranges from 10 V to 1000 V.
Minimum operating voltage required to sink current is 1.5 V.



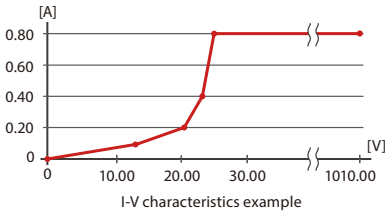
■ Maximum slew rate of 20 A/µs

The PLZ-5WH2 series boasts a 20 µs rise time*, easily satisfying the critical needs of power-supply evaluation tests demanding a fast transient response. *When using the PLZ20005WH2



■ Arbitrary I-V characteristics (ARB) mode

In ARB mode, arbitrary I-V characteristics can be set by registering multiple I-V characteristic points (pairs of voltage and current values). Three to 100 points can be registered, and the space between two points is linearly interpolated. The minimum voltage (0.00 V) and current (0.00 A) and the maximum voltage (1010.00 V) are fixed.



I-V characteristics example

Example of setting value (* Value is fixed)

Voltage[V]	Current[A]
0.00*	0.00*
12.00	0.10
20.50	0.20
23.00	0.40
24.50	0.80
1010.00*	0.80

■ Easy access with the built-in web server

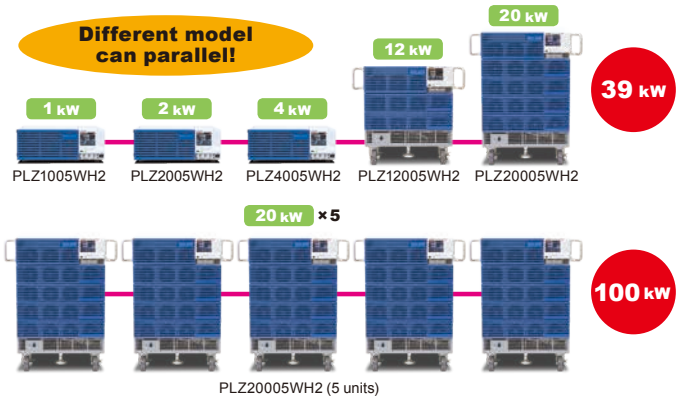
Use a browser from a PC, smartphone, or tablet to access the web server built into the PLZ-5WH2 series for convenient control and monitoring.

Use the latest browser version
(Recommended browser:
Internet Explorer11, Chrome, Safari).

* Connecting with a smartphone, tablet, etc. requires a Wi-Fi environment (wireless LAN router etc.).

■ Parallel operation

Parallel operation (max. 5 units) is available on all models by simply connecting an optional parallel-operation cable. This feature is available even among different models for a wide range of high power.
(up to 100 kW / 2000 A)
*A parallel cable needed to connect with each unit. A parallel cable is included with 12 kW and 20 kW models. A parallel-operation cable is not included with 1 kW, 2 kW or 4 kW models.



Maximum current and power during parallel operation using the same model

Model	Parallel operation number	Maximum current	Maximum power
PLZ20005WH2	2	800 A	40 kW
	3	1200 A	60 kW
	4	1600 A	80 kW
	5	2000 A	100 kW

● Parallel connection with PLZ-5WH series*
Must be PLZ-5WH as a Master with updated firmware to newest version.
*When parallel operation between 5WH and 5WH2, only same capacity model is available.

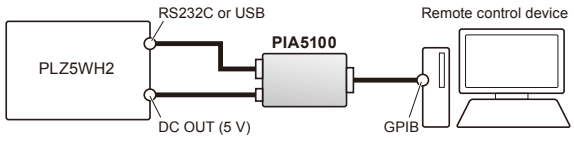
Options

■ GPIB converter

PIA5100

This converter converts RS232C or USB connection into GPIB, enabling remote control connection using GPIB as seen below.
[Accessories: Power cord set, Magnetic sheet]

[Connection example]



*For the details, please refer to page 42.

■ Parallel operation signal cable kit

PC01-PLZ-5W (approx. 30 cm)
PC02-PLZ-5W*(approx. 1 m)
*Supplied with PLZ12005WH2 and PLZ20005WH2.

■ Sequence creation and control software

SD033-PLZ-5WH2 (Wavy for PLZ-5WH2)

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-4W Series

USB GPIB RS232C DRIVERS

Suitable design for fuel cell, faster speed and lower voltage testing application of various devices!

The PLZ-4W Series Electronic Load unit is a multifunctional system designed to offer the highest levels of reliability and safety with operation function of constant voltage, constant current, constant power and constant resistance mode. And its control unit comes with GPIB, RS232C and USB as standard interface. The PLZ-4W Series are available in 5 models and which a 0 V input operating voltage is available in 2 models (PLZ164WA, PLZ664WA) suited to meet with the testing demands for the Fuel Cell, DC/DC converter, SW Power Supply, and any other devices required for the lower operating voltage application. The PLZ664WA offers the 132 A at 0 V input as a largest current rating in its class. (33 A for model PLZ164WA) Furthermore, the PLZ-4W features high speed slew rate when switching, it can be used as simulating load for the characteristic, performance, life cycle, aging test in the field of application in Automobile electronics, SW Power Supply manufacturer, Secondary Battery. To achieve large capacity for testing application at low cost, the PLZ1004W can be expanded up to 9 kW by using the 2 kW booster unit (PLZ2004WB).

Dimensions

Type I : 214.5(8.44″)W × 124(4.88″)H × 400(15.75″)Dmm(inch)
Type II : 429.5(16.91″)W × 128(5.04″)H × 400(15.75″)Dmm(inch)

Accessories

Setup Guide, Quick Reference(1 each for English and Japanese), CD-R(Contains the User's Manual and the Communication Interface Manual), Input power cable (with a SVT3 18 AWG 3 P plug, 2.4 m), Load input terminal cover, Lock plate (2 pcs.), Load input terminal bolt, nut and spring washer (2 sets)

Features

- Equipped with 6 operation modes (CC, CR, CV, CP, CC+CV, CR + CV)
- 0 V input operating voltage model is available (PLZ164WA, PLZ664WA)
- For transient switching operations, it is possible to set a slew rate (A/μs)
- Equipped with various types of protection circuits:
  Over Voltage Protection(OVP), Over Current Protection(OCP), Over Power Protection(OPP), Over Heat Protection(OHP), Under Voltage Protection(UVP), And Reverse Connection Protection(REV)
- GPIB/RS232C/USB are standard interface

Specifications

Model	Rating			Constant current mode				Constant voltage mode			
	Operating voltage	Current	Power	Operating range			Ripple	Operating range		Resolution	
	V	A	W	Range H (A)	Range M (A)	Range L (A)	mA rms	Range H (V)	Range L (V)	Range H (mV)	Range L (mV)
PLZ164W	1.5 to 150 *1	33	165	0 to 34.65	0 to 3.465	0 to 346.5 m	3	1.5 to 157.5	1.5 to 15.75	10	1
PLZ334W		66	330	0 to 69.3	0 to 6.93	0 to 693 m	5				
PLZ1004W		200	1000	0 to 210	0 to 21	0 to 2.1	20				

Model	Constant resistance mode			Constant power mode			Weight	Dimensions	Power consumption
	Operating range *3			Operating range			kg/lb	Type	Approx. VA
	Range H (S)	Range M (S)	Range L (S)	Range H (W)	Range M (W)	Range L (W)			
PLZ164W	23.1 to 0	2.31 to 0	0.231 to 0	0 to 173.25	0 to 17.325	0 to 1.7325	7/15.43	I	80
PLZ334W	46.2 to 0	4.62 to 0	0.462 to 0	0 to 346.5	0 to 34.65	0 to 3.465	8/17.64	I	90
PLZ1004W	139.9968 to 0	13.99968 to 0	1.399968 to 0	0 to 1050	0 to 105	0 to 10.5	15/33.07	II	160

● 0 V INPUT OPERATING VOLTAGE TYPE

Model	Rating			Constant current mode				Constant voltage mode			
	Operating voltage	Current	Power	Operating range			Ripple	Operating range		Resolution	
	V	A	W	Range H (A)	Range M (A)	Range L (A)	mA rms	Range H (V)	Range L (V)	Range H (mV)	Range L (mV)
PLZ164WA	0 to 150 *2	33	165	0 to 34.65	0 to 3.465	0 to 346.5 m	7.5	0 to 157.5	0 to 15.75	10	1
PLZ664WA		132	660	0 to 138.6	0 to 13.86	0 to 1.386	30				

Model	Constant resistance mode			Constant power mode			Weight	Dimensions	Power consumption
	Operating range *3			Operating range			kg/lb	Type	Approx. VA
	Range H (S)	Range M (S)	Range L (S)	Range H (W)	Range M (W)	Range L (W)			
PLZ164WA	23.1 to 0	2.31 to 0	0.231 to 0	0 to 173.25	0 to 17.325	0 to 1.7325	7.5/16.53	I	300
PLZ664WA	92.4 to 0	9.24 to 0	0.924 to 0	0 to 693	0 to 69.3	0 to 6.93	16/35.27	II	1500

*1: The minimum operating voltage (including the voltage drop due to the wire inductance component) in switchingmode increases by 0.15 V per 1 A/μs at slew rate settings greater than 5 A/μs.
*2: The minimum operating voltage (including the voltage drop due to the wire inductance component) in switchingmode increases by 0.3 V per 1 A/μs at slew rate settings greater than 5 A/μs.
*3: Conductance [S] = Input current [A]/input voltage [V] = 1/resistance [Ω]

Common Specifications

Switching operation ····· Operation mode: CC and CR
Frequency range: 1Hz to 20kHz
Soft start operation ····· Operation mode: CC and CR
Time range: 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms or 200 ms
Remote sensing ····· Sensing voltage: 2 V

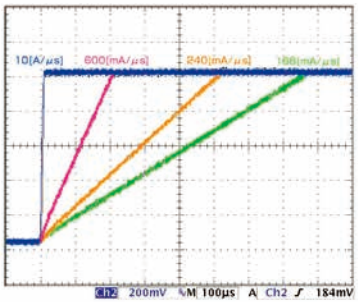
Input voltage ····· PLZ164W/PLZ334W/PLZ1004W:
100 VAC to 240 VAC (90 VAC to 250 VAC) single phase,
PLZ164WA/PLZ664WA:
100 VAC to 120 VAC/ 200 VAC to 240 VAC
(90 VAC to 132 VAC / 180 VAC to 250 VAC) single phase

Functions

■ High-speed response and variable slew-rate

Lately the Electronic Load has been required to apply faster response to comply with such as DC/DC converters with high-speed performance.

With the PLZ-4W Series, it realizes a faster response of rise/fall time as calculated conversion value with 10 µs, and enabling a transient response test for the direct current and accurate reproduction of a simulation waveform as a dummy load. In addition, instead of the conventional rise/fall time settings, it also can be set with a slew rate (A/µs). As for the setting value, it can be varied continuously, and be possible to optimize transient control for voltage drops due to wiring inductance, constant-voltage power supply, etc., when the load current is switched on.



▲ A current waveform shifting by variable slew-rate

* Adequate slew rate performance is guaranteed as long as the change in the current remains within the 2 % to 100 % range of the rating.(M range 20 % to 100 %)
The rise time to the rated current takes approximately 10 µs. When the variation of the current value is small, the slew rate may not be achieved to the setting value.

■ 0 V input

The PLZ164WA and PLZ664WA permit a load input up to the rated current even when the Input Voltage is set for 0 V. This is an absolute required specification for single cell tests of the fuel cells. Also, because of the low power consumption and scaling down of semi-conductor processes, semi-conductor devices are experiencing further voltage reductions. The Load can meet with these applications of power evaluation test. Higher precision is offered for current settings. Resolutions in micro currents are ensured by 3-range configuration. (Resolving power 10 µA set with L range of PLZ164W and PLZ164WA is possible) Further, each display for the voltmeter, ammeter, and wattmeter now uses a 5-digit display.

■ Sequence function

Sequence patterns set as you requested can be saved in the built-in memory. In the sequence program, 10 normal sequences and 1 first sequence can be saved. 256 steps of normal sequences, and 1,024 steps of the first sequence can be saved in each program. Simple editing is possible using the large liquid crystal display (LCD).

■ Booster unit PLZ2004WB*

To achieve a large capacity system at low cost, the PLZ1004W has an expandable option PLZ2004WB as a booster unit. Using one unit of PLZ1004W as a master unit, a maximum of 4 booster units can be parallel connected. (Max. 9 kW, 1800 A)

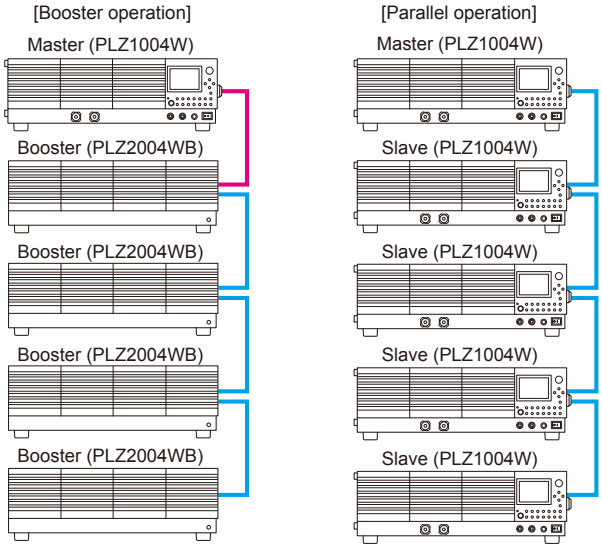
■ Specifications

Operating voltage	1.5 V to 150 V
Current	400 A
Power	2000 W
Input voltage	100 VAC to 240 VAC (90 VAC to 250 VAC) single phase
Power consumption	200 VA(max)
Dimensions	Type II (The depth is 550(600) mm)
Weight	approx. 23 kg

*Exclusively used for the PLZ1004W. It can not be used to connect any other model.

■ Parallel operation

Under parallel operation, the same model can be parallel connected to a maximum of 5 units when booster unit is not used. (Max. 5 kW, 1000 A)



PC01-PLZ-4W: The cable for Boosters and Master/Slave units.
PC02-PLZ-4W: The cable for between Master unit and Booster unit.

* Do not stack three or more loads on top of each other.
You can stack loads (booster and master unit), but for safety reasons, only stack up to two units. If you want to use two or more boosters, we recommend you to rack mount them.

Options

■ Accessory Kit

OP01-PLZ-4W
(used for the connection of J1 connector on the rear panel when operating by external control)
● Connector, Semi-cover, Pin 20 pcs.

■ Parallel Operation Cable

PC01-PLZ-4W
(for boosters and master/slave units, 300 mm)

PC02-PLZ-4W
(for between master unit and booster unit, 550 mm)

■ Sequence Creation Software

Wavy for PLZ-4W

[NOTICE] PLZ164WA and PLZ664WA

● Operating voltage is secured by the input node of the load device. Please select load wiring that does not make input node voltage of the load device become 0V or less. In addition, this equipment detects non-input. It detects non-input and stops electric current when the input node voltage of the load device is 0.3 V or less and input current is approximately 1 % of the current rating or less.
● PLZ164WA and PLZ664WA are equipped with bias supply inside. In the case of supply for which diode is arranged from minus output to plus output, such as switching supply, an electric current flows from the bias supply to the diode and the reverse-connection alarm activates when the reverse voltage is applied from the load input terminal when turning off the output of the supply under test while this equipment is loaded on.
● Because a noise filter is used for the primary input for PLZ164WA and PLZ664WA, the leakage breaker, etc. may be activated, depending on the environment of the input power, when using multiple quantities of them at the same time. Therefore, we provide models for customers who are planning to use multiple devices at the same time. If you have any other questions, please contact our sales department for details.

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-4WL Series

USB GPIB RS232C DRIVERS CE PLZ334WL

*Refer to page 8

High Speed-Large Current DC Electronic Load (50 A/μs)

While the PLZ-4WL series succeeds to the superior operability of our conventional model of the PLZ-4W series, the PLZ-4WL series realizes the high speed rise and fall time (slew rate of 50 A/μs.) in the range of low voltage with large current. The PLZ-4WL offers 6 operation modes, and equips with various features such as sequence operation, switching operation, soft-start function, and time and voltage measurement. The PLZ-4WL applies not only for the conventional load test of the CPU power supply, but also it is capable even faster current response test. In addition, the PLZ-4WL is a space-saving design (about 50 % less volume of the conventional model) that can save the facility space of the testing site, and it can be applied for the single cell testing of the large scale rechargeable battery.

Dimensions

214.5(8.44")W × 124(4.88")H × 400(15.75")Dmm(inch)

Accessories

Setup Guide, Quick Reference (1 each for English and Japanese), CD-R (Contains the User's Manual and the Communication Interface Manual), Power cord, Set of screws for the load input terminal (2 sets.), Load input terminal cover, Screws for the Input terminal cover (2 pcs.), Protection dummy plug for J1 terminal, Connecting cable to the chassis

Options

■ Low inductance cable

①TL01-PLZ (50 cm) ②TL02-PLZ (1 m) ③TL03-PLZ (2 m)

Inductance level (TYP level)	140nH	150nH	200nH

■ Analog remote control connector kit
OP01-PLZ-4WL

■ Sequence Creation Software
Wavy for PLZ-4W

Features

- Full-Load Current of 100 A at 0.3 V! *PLZ334WL
  Possible to operate as low as 50 mV of the input voltage
- Realize the fast slew rate of 50 A/μs at 2.3 V of the load input terminal voltage. (Rise/Fall time conversion: Approx. 2 μs)
- Current setting resolution: 50 μA (L range) *PLZ334WL
- 6 operation modes (CC, CR, CV, CP, CC+CV, CR + CV)
- Equipped with Sequence function and Switching function
- Elapsed Time Display function and Auto Load-Off Timer function are convenient for the discharge tests of batteries
- Available for input voltage range 100 Vac to 240 Vac
- Equipped with various types of protection circuits:
  Over Voltage Protection(OVP), Over Current Protection(OCP), Over Power Protection(OPP), Over Heat Protection(OHP), Under Voltage Protection(UVP), And Reverse Connection Protection(REV)
- Optional Low Inductance cables are available exclusively for PLZ-4WL series
- GPIB/RS232C/USB are standard interface

Specifications

Model	Rating			Constant Current (CC) mode				Constant Resistance (CR) mode		
	Operating voltage	Current	Power	Operating range			Ripple	Operating range		
	V	A	W	Range H (A)	Range M (A)	Range L (mA)	mA rms	Range H (S)	Range M (S)	Range L (S)
PLZ164WL	0.3 to 30	50	165	0 to 50	0 to 5	0 to 500	4	165 to 3 m	16.5 to 300 μ	1.65 to 30 μ
PLZ334WL		100	330	0 to 100	0 to 10	0 to 1	8	330 to 6 m	33.3 to 600 μ	3.3 to 60.0 μ

Model	Constant Voltage (CV) mode				Constant Power (CP) mode						Ammeter		Weight
	Operating voltage		Resolution		Operating range			Resolution					kg/lb
	H (V)	L (V)	H (V)	L (V)	Range H (W)	Range M (W)	Range L (W)	H (W)	M (W)	L (W)	H, M (A)	L (W)	
PLZ164WL	0.3 to 30	0.3 to 4	2 m	200 μ	16.5 to 165	1.65 to 16.5	0.165 to 1.65	10 m	1 m	0.1 m	0.000 to 50.000	0.00 m to 500.00 m	6.5/14.33
PLZ334WL					33 to 330	3.3 to 33	0.33 to 3.3	20 m	2 m	0.2 m	0.00 to 100.00	0.0000 to 1.0000	8.0/17.64

Common Specifications

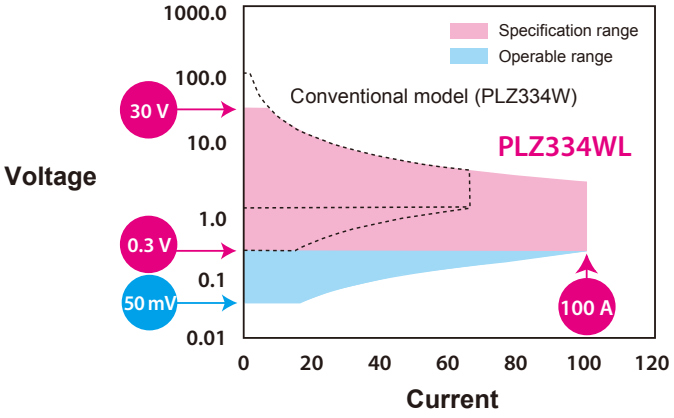
Input voltage range..... 100 VAC to 240 VAC (90 VAC to 250 VAC), Single phase
Input frequency range..... 47 Hz to 63 Hz
Inrush current..... 65 Amax(Approximately 35 A for the input voltage of 100 VAC)
Operating temperature range... 0 °C to 40 °C
Operating humidity range..... 20 % to 85 % rh (without condensation)
Storage temperature range.... -20 °C to 70 °C
Storage humidity range..... 90 % RH or less (without condensation)
Isolation voltage..... ±500 V

Insulation resistance
Primary - Input terminal/Primary - Chassis/Input Terminal - Chassis
..... 500 VDC, 30 M or more (ambient humidity of 70 % rh or less)
Withstand voltage
Primary - Input terminal/Primary - Chassis
..... No abnormalities at 1500 VAC for 1 minute.

Functions

■ Realizing the low voltage operation

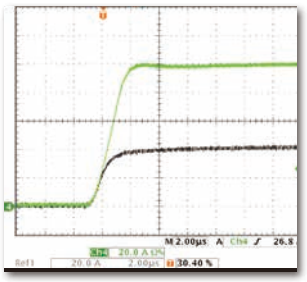
Possible to operate as low as 50 mV by the input voltage. Even below the input voltage of 0.3 V, this product can be used by reducing the current.



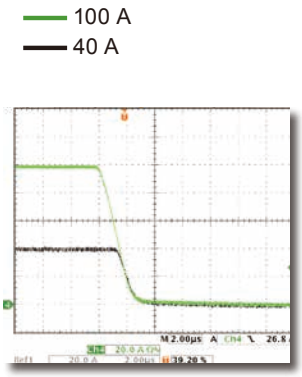
▲ Conceptual drawing of the operating range

■ Fast Slew rate

Realize the slew rate of 50 A/µs at 2.3 V of the load input terminal voltage.



▲Current rise time conversion:
Approx. 2 µs (PLZ334WL)



▲Current fall time conversion:
Approx. 2 µs(PLZ334WL)

■ Low range (1/100) feature

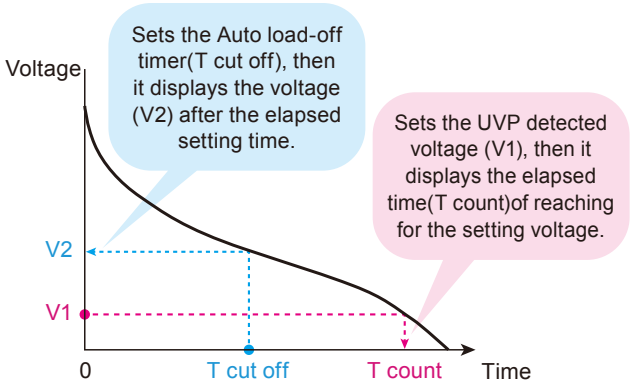
In CC, CR, and CP modes, three ranges are available: H, M, and L.
The L range is 1/100, enabling coverage from low to high power with a single unit.

● Current setting resolution

	PLZ334WL
H	5 mA
M	500 µA
L	50 µA

■ Convenient feature for the discharge testing

The Auto load-off timer and the Cut-off features can be applied to the discharge capacity measurement of the rechargeable battery



Multifunctional Electronic Load (CC/CV/CR/CP) * While Supplies Last

PLZ-4WH Series

USB GPIB RS232C DRIVERS CE

*Refer to page 8

High-Voltage Electronic Load with a maximum operating voltage to 650 V for EV and HEV high-voltage converter, battery testing.
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 650 V. Furthermore, when the booster unit (PLZ2004WHB) is connected, it can be realized up to 9 kW/450 A with less space and at a low cost. The USB, GPIB, and RS232C comes as standard interface that supports automated testing applications.

Dimensions

Type I : 214.5(8.44″)W × 124(4.88″)H × 400(15.75″)Dmm(inch)
Type II : 429.5(16.91″)W × 128(5.04″)H × 400(15.75″)Dmm(inch)

Accessories

Setup Guide, Quick Reference (1 each for English and Japanese), CD-R(Contains the User's Manual and the Communication Interface Manual), Power cord (with plug, length: 2.4 m), Load input terminal cover, Lockplate for the load input terminal cover (2 pcs.), Set of screws for the load input terminal (2 sets.)

Features

- Maximum operating voltage: 650 V
- With connecting boosters, maximum of 9 kW/450 A
- 6 operation modes (CC, CR, CV, CP, CC+CV, CR + CV)
- Voltage monitor terminal for monitoring high voltage
- Sequence function (up to 1024 steps)
- Remote sensing function
- Equipped with various types of protection circuits: Over Voltage Protection(OVP), Over Current Protection(OCP), Over Power Protection(OPP), Over Heat Protection(OHP), Under Voltage Protection(UVP), And Reverse Connection Protection(REV)
- GPIB/RS232C/USB are standard interface
- Soft-start function to limit output voltage distortion during EUT startup (CC)

Specifications

Model	Rating			Constant current mode				Constant voltage mode			
	Operating voltage	Current	Power	Operating range			Ripple	Operating range		Resolution	
	V	A	W	Range H (A)	Range M (A)	Range L (A)	mA rms	Range H (V)	Range L (V)	Range H (mV)	Range L (mV)
PLZ164WH	5 to 650	8.25	165	0 to 8.6625	0 to 866.25 m	0 to 86.625 m	2	0 to 682.5	0 to 68.25	20	2
PLZ334WH		16.5	330	0 to 17.325	0 to 1.7325	0 to 173.25 m	4				
PLZ1004WH		50	1000	0 to 52.5	0 to 5.25	0 to 525 m	12				

Model	Constant resistance mode			Constant power mode			Weight	Dimensions	Power consumption
	Operating range			Operating range			kg/lb	Type	Approx. VA
	Range H (S)	Range M (S)	Range L (S)	Range H (W)	Range M (W)	Range L (W)			
PLZ164WH	1.7325 to 0	173.25 to 0	17.325 to 0	0 to 173.25	0 to 17.325	0 to 1.7325	7/15.43	I	80
PLZ334WH	3.465 to 0	346.5 m to 0	34.65 m to 0	0 to 346.5	0 to 34.65	0 to 3.465	8/17.64	I	90
PLZ1004WH	10.5 to 0	1.05 to 0	105 m to 0	0 to 1050	0 to 105	0 to 10.5	16/35.27	II	160

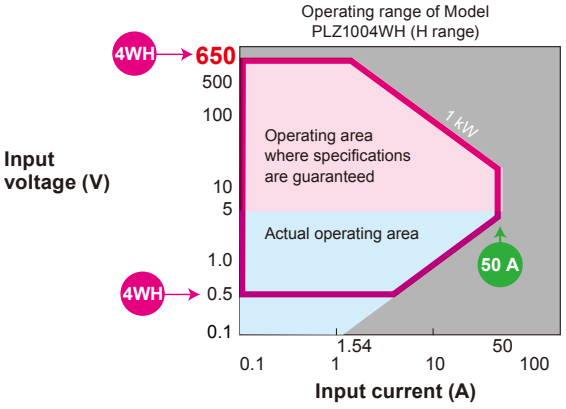
Common Specifications

Input voltage range ..... 100 VAC to 240 VAC (90 VAC to 250 VAC), Single phase
Switching operation ····· Operation mode: CC and CR
Soft start operation ····· Operation mode: CC
Time range ..... 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, 50 ms, 100 ms or 200 ms
Remote sensing ····· Sensing voltage: 2 V

Functions

■ Operating range up to 650 V

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



■ 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	300 µA	1 mA	2 mA
M	30 µA	100 µA	200 µA
L	3 µA	10 µA	20 µA

■ Booster unit PLZ2004WHB*

By connecting up to 4units of PLZ2004WHB boosters (sold separately) combined with the PLZ1004WH, it is possible to configure the system as an Electronic Load unit for up to 9 kW/450 A. 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.

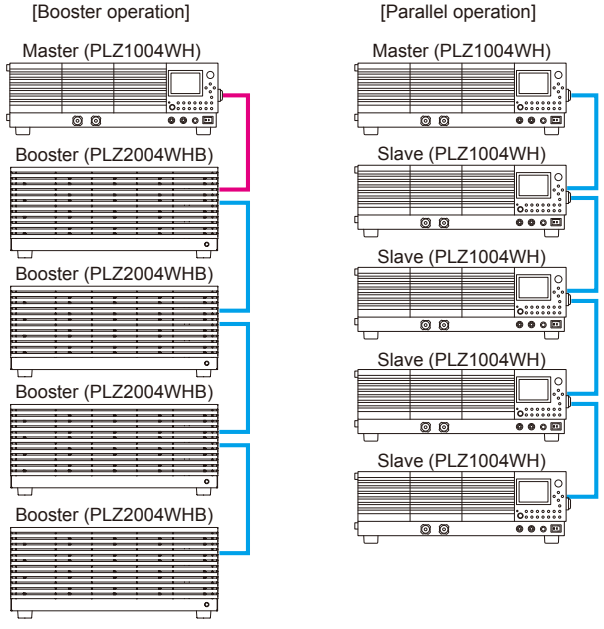
■ Specifications

Operating voltage	5 V to 650 V
Current	100 A
Power	2000 W
Input voltage	100 VAC to 240 VAC (90 VAC to 250 VAC) single phase
Power consumption	200 VA(max)
Dimensions	Type II (The depth is 550(600) mm)
Weight	approx. 24 kg

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

■ Parallel operation

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 (5 kW/250 A 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.

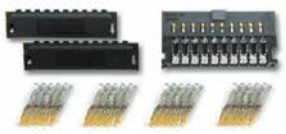


PC01-PLZ-4W: The cable for Boosters and Master/Slave units.
PC02-PLZ-4W: The cable for between Master unit and Booster unit.

Options

■ Accessory Kit

OP01-PLZ-4W
(used for the connection of J1 connector on the rear panel when operating by external control)
● Connector, Semi-cover, Pin 20 pcs.



■ Parallel Operation Cable

PC01-PLZ-4W
(for boosters and master/slave units, 300 mm)

PC02-PLZ-4W
(for between master unit and booster unit, 550 mm)

■ Sequence Creation Software

Wavy for PLZ-4W

● Large Capacity Model (Smart Rack/Load Pack) <PLZ-4W SR/LP, PLZ-4WH SR/LP Series> Lineup

Please refer to page 63 to 68 for product detail.

Features

The PLZ-4W SR/LP series is a large capacity model using PLZ1004W and PLZ2004WB booster assembled in its exclusive rack system as well as the PLZ-4WH SR/LP series using PLZ1004WH and PLZ2004WHB.
System up to 13 kW, 2600 A is available for the PLZ-4W SR/LP series and 13 kW, 650 A for the PLZ-4WH SR/LP series.

- The system offers from 5 kW to 13 kW with two types of rack system (SR/LP type), 12 models are available.
- Assembled with exclusive components based on optimization design concept.
- Delivers the system with fully assembled and tested, so immediate operation is possible.
- The industry's smallest in its class for the multi-functional high-speed response DC electronic load.
- USB/RS232C/GPIB as standard interface.
- Capable of operation using the Sequence Creation software "Wavy".

■ PLZ-4W SR/LP Series Lineup Operating voltage : 1.5 V to 150 V

	PLZ-4W Smart Rack			PLZ-4W Load Pack		
Model	PLZ5004W SR	PLZ7004W SR	PLZ9004W SR	PLZ9004W LP	PLZ11004W LP	PLZ13004W LP
Maximum input rating	5kW / 1000A	7kW / 1400A	9kW / 1800A	9kW / 1800A	11kW / 2200A	13kW / 2600A
						

■ PLZ-4WH SR/LP Series Lineup Operating voltage : 5 V to 650 V

	PLZ-4WH Smart Rack			PLZ-4WH Load Pack		
Model	PLZ5004WH SR	PLZ7004WH SR	PLZ9004WH SR	PLZ9004WH LP	PLZ11004WH LP	PLZ13004WH LP
Maximum input rating	5kW / 250A	7kW / 350A	9kW / 450A	9kW / 450A	11kW / 550A	13kW / 650A
						

* Definition of Series Name: SR (Smart Rack), LP (Load Pack)

Options

■ High Current Load Wire *Solderless terminals on both ends.

Model	DC14-2P3M-M12M8	DC38-2P3M-M12M8	DC80-2P3M-M12M8	DC80-2P3M-M12M12	DC150-2P3M-M12M12	DC150-4P3M-M12M12	DC600-2P3M-M12M12
Maximum Allowable voltage	650 V						150 V
Maximum Allowable current	50 A	100 A	200 A	200 A	300 A	500 A	1000 A
Terminal	M12/M8	M12/M8	M12/M8	M12/M12	M12/M12	M12/M12	M12/M12
Nominal Cross-Sectional Area	14 mm^2 (Equivalent of AWG 5)	38 mm^2 (Equivalent of AWG 1)	80 mm^2 (Equivalent of AWG 3/0)	80 mm^2 (Equivalent of AWG 3/0)	150 mm^2 (Equivalent of AWG 6/0)	150 mm^2 (Equivalent of AWG 6/0)	600 mm^2
Length (m(inch))/ Weight *Per cable	Approx.3 (11,81") / Approx.0.5 kg(1.10 lbs)	Approx.3 (11,81") / Approx1.4 kg (3.09 lbs)	Approx.3 (11,81") / Approx.2.8 kg (6.17 lbs)	Approx.3 (11,81") / Approx.2.8 kg (6.17 lbs)	Approx.3 (11,81") / Approx.5 kg (11.02 lbs)	Approx.3 (11,81") / Approx.5 kg (11.02 lbs)	Approx.3 (11,81") / Approx.20 kg (44.09 lbs)
Exterior design						 (4 sets)	

Dimensions

PLZ5004W SR	432.6 (545) W × 469.6 (570) H × 764.7 (955) D mm
PLZ7004W SR	432.6 (545) W × 602.3 (705) H × 764.7 (955) D mm
PLZ9004W SR	432.6 (545) W × 735 (835) H × 764.7 (955) D mm
PLZ9004W LP PLZ11004W LP PLZ13004W LP	570 W × 1350 (1435) H × 950 (1020) D mm

PLZ5004WH SR	432.6 (545) W × 559.6 (660) H × 764.7 (955) D mm
PLZ7004WH SR	432.6 (545) W × 737.3 (840) H × 764.7 (955) D mm
PLZ9004WH SR	432.6 (545) W × 915 (1015) H × 764.7 (955) D mm
PLZ9004WH LP PLZ11004WH LP PLZ13004WH LP	570 W × 1350 (1435) H × 950 (1020) D mm

Common Specifications

Input voltage range.....100 V AC to 240 V AC (90 V AC to 250 V AC), single phase
Input frequency range.....47 Hz to 63 Hz

Operating temperature range.....0 °C to 40 °C
Operating humidity range.....20 %rh to 85 %rh (without condensation)
Storage temperature range .....-25 °C to 70 °C
Storage humidity range .....90 %rh or less (without condensation)

Multifunctional Electronic Load (CC/CV/CR/CC+CV/CR+CV)

PLZ-U Series

GPIB RS232C DRIVERS CE

*Refer to page 8

This photo shows a 5-channel frame housing 5 units.
The rack mount bracket is optional.

*Multi-Channel Load Systems Can Be Built Easily! Operating Multiple Units in Parallel Offers Large Capacity!**

The PLZ-U Series provides a set of compact, high-performance multi-channel electronic load systems capable of operating in five modes - constant current, constant resistance, constant voltage, constant current+constant voltage and constant resistance+constant voltage. Adopting the modular (plug-in) design, the Series consists of four models - two frame models and two load unit models. The PLZ-30F frame can configure the load units up to three channels, and the PLZ-50F frame can configure up to five channels. Two load unit models are available, the PLZ-70UA (75-watt load that operates even at 0 V) and PLZ-150U (150-watt load that operates from 1.5 V up). Load units can be operated in parallel to increase the current capacity or power capacity. By combining different models of load units and frame, the power capacity can be changed from 75 W to 750 W (when five PLZ150U units are mounted in a PLZ-50F frame). Supporting the GPIB and RS232C interfaces as standard, the electronic load can be built into various types of test systems, making it useful in testing fuel cells, secondary cells, DC/DC converters, switching power supplies, multiple-output power supplies, and more.

*Only load units of the same model can be operated in parallel.

Dimensions

PLZ-30F: 292(11.5″)W × 128(5.04″)H × 400(15.75″)Dmm(inch)
PLZ-50F: 435(17.13″)W × 128(5.04″)H × 400(15.75″)Dmm(inch)

Application software (downloadable free of charge)

Application software for controlling this system from a PC is available from our website.

Accessories

Load unit: Operation manual, Rear load input terminal cover, Load input connector screw set (2 sets/M6 bolt, M6 nut, M6 spring washer and M4 screw), Load unit attachment screw (2 pcs./M3-10 screw), Sensing terminal screw (2 pcs./M3-6 screw, attached to the unit)

Frame: Operation manual, Power cord (with SVT3 18AWG 3-prong plug, cable length of 2.4 m), Front/Rear blank panel (2 pcs./PLZ-30F or 4 pcs./PLZ-50F), Protection dummy plug (2 pcs./for the FRAME CONT connector, attached to the unit)

Specifications

Model	Rating				Constant current mode				Constant voltage mode			
	Operating voltage	Current/Power			Operating range/Resolution			Ripple	Operating range		Resolution	
	V	Range H	Range M	Range L	Range H (A)	Range M (A)	Range L (mA)	mA rms	Range H (V)	Range L (V)	Range H (mV)	Range L (mV)
PLZ70UA	0 to 150	15 A/75 W	1.5 A/75 W	150 mA/22.5 W	0 to 15/0.001	0 to 1.5/0.0001	0 to 150/0.01	7.5	0 to 150	0 to 15	10	1
PLZ150U	1.5 to 150	30 A/150 W	3 A/150 W	300 mA/45 W	0 to 30/0.002	0 to 3/0.0002	0 to 300/0.02	3	1.5 to 150	1.5 to 15		

Model	Constant resistance mode Operating renge			Ammeter Measurement range/Resolution			Volmeter Operating range	Weight
	Range H (S)	Range M (S)	Range L (mS)	Range H (A)	Range M (A)	Range L (mA)	V	kg/lb
PLZ70UA	10 to 0	1 to 0	100 to 0	0 to 15/0.001	0 to 1.5/0.0001	0 to 150/0.01	0 to 150	2/4.41
PLZ150U	20 to 0	2 to 0	200 to 0	0 to 30/0.001	0 to 3/0.0001	0 to 300/0.01		

Isolation voltage of the load input terminal/withstand voltage between load input terminal channels: 500 VDC

Model	Number of installable load modules	Power consumption		Weight	
		Frame alome	Fully equipped with load units	Frame alome	Fully equipped with load units
		VA	VA	kg/lb	kg/lb
PLZ-30F	3	33	300	5/11.02	11/24.25
PLZ-50F	5	40	500	7/15.43	17/37.48

Common Specifications

Switching mode ·····Operation mode: CC and CR
Selectable frequency range: 1 Hz to 20 kHz

Slew rate

		PLZ150U	PLZ70UA
Operation mode		CC and CR	
Selectable range (CC)	Range H	0.10 A/µs to 2.40 A/µs	0.05 A/µs to 1.20 A/µs
	Range M	0.10 A/µs to 0.24 A/µs	0.05 A/µs to 0.12 A/µs
	Range L	24 mA/µs *1	12 mA/µs *1
Selectable range (CR)	Range H	0.10 A/µs to 0.24 A/µs *1	0.05 A/µs to 0.12 A/µs *1
	Range M	24 mA/µs	12 mA/µs
	Range L	2.4 mA/µs *1	1.2 mA/µs *1
Resolution		0.01 A/µs	
Accuracy of setting*2		±(10 % of set + 5 µs)	

Sequence function·····Operation mode: CC and CR
Maximum number of steps: 255
Step execution time: 1 ms to 9999 s
Number of loops: 1 to 9999 (9999 is infinite loop)

Soft start operation·····Operation mode: CC
Selectable range: 0.1 ms, 1 ms, 3 ms, 10 ms, 30 ms, 100 ms, or 300 ms

Remote sensing·····Sensing voltage: 2 V for a single line

*1: Fixed Value
*2: Time to reach from 10 % to 90 % when the current is changed from 2 % to 100 % of the rated current of H range.

Features

- Slew rate of 2.4 A/µs in the rising and falling edges in CC mode (PLZ150U)
- Built-in three ranges; voltmeter, ammeter, and wattmeter functions that provide readings of up to five digits
- The current slew rate can be changed continuously in constant current and constant resistance modes
- Supports 0-V input - an indispensable feature for testing single-cell fuel cells
- Individual units (channels) can operate either independently or in synchronization
- Up to 5 load units of the same model can be operated in parallel.
- Up to three values can be stored in memory for each most frequently used operation mode and range
- Equipped with various types of protection circuits:
  Over Voltage Protection(OVP), Over Current Protection(OCP), Over Power Protection(OPP), Over Heat Protection(OHP), Under Voltage Protection(UVP), And Reverse Connection Protection(REV)
- External control is available to turn on or off the output
- GPIB/RS232C/USB are standard interface

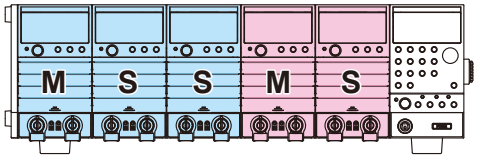
Options

■ Control Flat Cable
PC01-PLZ-4W (300 mm)
PC02-PLZ-4W (550 mm)
(for connection between frames)

■ Sequence Creation Software
Wavy for PLZ-U

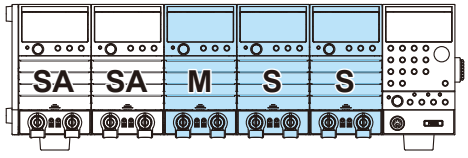
Parallel operation to offer large capacity

Up to 5 adjacent load units of the same models can be operated in parallel. For example, you can build a 375-watt load system by operating five PLZ70UA load units in parallel in the PLZ-50F frame or a 750-watt load system by operating five PLZ150U load units in parallel.



M: Master
S: Slave

When three load units of one model and two load units of another model are operated in parallel in the PLZ-50F frame



M: Master
S: Slave
SA: Standalone load unit

When three load units of the same model are operated in parallel and two standalone load units are operated independently in the PLZ-50F frame

Number of parallel operated load modules and capacities

Number of parallel operated load modules	PLZ70UA	PLZ150U
2	30 A/150 W	60 A/300 W
3	45 A/225 W	90 A/450 W
4	60 A/300 W	120 A/600 W
5	75 A/375 W	150 A/750 W

[NOTICE]PLZ70UA

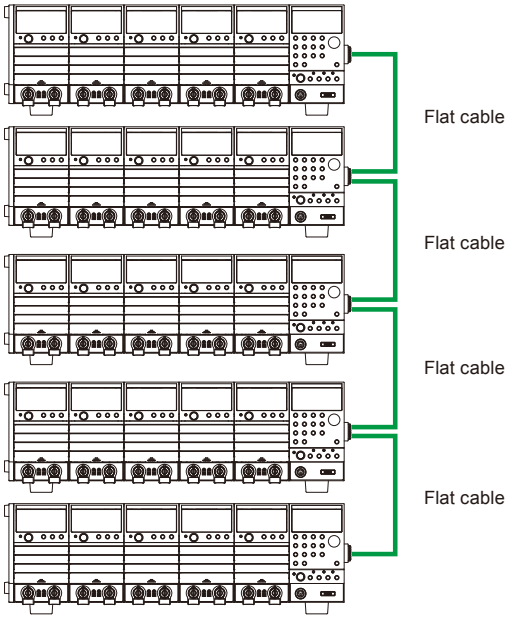
The operating voltage is guaranteed by the input terminal of the load unit. Be sure to select a load cable that never inputs a voltage of 0 V or less to the load unit input terminal. This system detects the no-signal condition. The no-signal condition is detected when the voltage at the load unit input terminal is 0.3 V or less and when the input current is equal to or less than about 1 % of the rating, in which case the current will stop flowing.

Ordering code * Please inquire by following code

Model name	Frame model	PLZ70UA	PLZ150U	Total number of unit
PLZ30F-70UA0-150U1	PLZ-30F	0	1	1
PLZ30F-70UA0-150U2		0	2	2
PLZ30F-70UA0-150U3		0	3	3
PLZ30F-70UA1-150U0		1	0	1
PLZ30F-70UA1-150U1		1	1	2
PLZ30F-70UA1-150U2		1	2	3
PLZ30F-70UA2-150U0		2	0	2
PLZ30F-70UA2-150U1		2	1	3
PLZ30F-70UA3-150U0		3	0	3
PLZ50F-70UA0-150U1	PLZ-50F	0	1	1
PLZ50F-70UA0-150U2		0	2	2
PLZ50F-70UA0-150U3		0	3	3
PLZ50F-70UA0-150U4		0	4	4
PLZ50F-70UA0-150U5		0	5	5
PLZ50F-70UA1-150U0		1	0	1
PLZ50F-70UA1-150U1		1	1	2
PLZ50F-70UA1-150U2		1	2	3
PLZ50F-70UA1-150U3		1	3	4
PLZ50F-70UA1-150U4		1	4	5
PLZ50F-70UA2-150U0		2	0	2
PLZ50F-70UA2-150U1		2	1	3
PLZ50F-70UA2-150U2		2	2	4
PLZ50F-70UA2-150U3		2	3	5
PLZ50F-70UA3-150U0		3	0	3
PLZ50F-70UA3-150U1		3	1	4
PLZ50F-70UA3-150U2		3	2	5
PLZ50F-70UA4-150U0		4	0	4
PLZ50F-70UA4-150U1		4	1	5
PLZ50F-70UA5-150U0		5	0	5

Frame control

By connecting two or more frames, you can use one frame to control the other frames (up to five frames can be connected at a time). Operations such as load on/off and preset memory call can be performed.



Regenerative DC Electronic Load

* While Supplies Last

PLZ6000R

USB GPIB RS232C

Dimensions / Weight

430(11.5″)W × 173(5.04″)H × 550(15.75″)Dmm(inch) / 43kg(94.8 lbs.)

Accessories

Operation Manual, DC input terminal cover, Lock plate (2 pcs.), Lock plate setscrew(4 pcs.), DC input terminal bolt(4 pcs.), J1/ Parrallel IN/OUT protection socket (3 pcs.), Weight sticker

Compact and Environment-friendly DC electronic load of the power line regeneration type

The PLZ6000R is a DC electronic load that regenerates load power to the AC line. Conventional electronic loads consume the load power by having semiconductor devices convert it into heat. By contrast, the PLZ6000R converts the load power into reusable electric power, rather than converting it into heat, and feeds this power to the AC line, thereby substantially reducing the amount of waste energy.
PLZ6000R is designed as an environment-friendly electronic load that can contribute significantly to your energy saving efforts.

Features

- 6 operation modes (CC, CR, CV, CP, CC+CV, CR + CV)
- Sequence function
  (Up to 10 Programs and each consisting up to 256 steps)
- Parallel operation up to 5 units (Max 30 kW)
- Soft start function (The setting time can be selected)
- ABC preset memories
- GPIB/RS232C/USB are standard interface

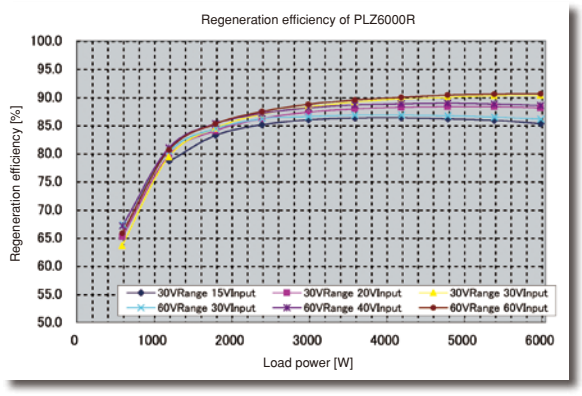
Rating				Constant Current mode				Constant Voltage mode	
Operating voltage		Current	Power	Operating voltage	Resolution	Ripple*1		Operating range	Resolution
V	V	A	W	A	mA	mA rms	A p-p	V	mV
30 V range	3 to 30	400	6000	0 to 400	10	500	2	3 to 30	1
60 V range	6 to 60	200		0 to 200	10			6 to 60	

Constant Resistance mode*2			Constant Power mode		Display		
Operating range		Resolution	Operating voltage	Resolution	Voltmeter	Ammeter	Wattmeter
V	S	mS	W	W	V	A	W
30 V range	134 to 2.5 m (7.4627 mΩ to 400 Ω)	2.5	0 to 6000	0.1	60.000	400.00	6000.0
60 V range	34 to 2.5 m (29.412 mΩ to 400 Ω)						

*1: At the setting current greater than 5 A
*2: In the Constant Resistance Mode (CR Mode), the conductance value should be set at the reciprocal of the resistance value. The resistance value which is counted backward from the conductance value will be also displayed. Conductance value [S]= 1/Resistance value [Ω]

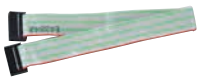
■ General Specifications
Input voltage range.....200 VAC to 220 VAC (Three-Phase Three-wire)
Input frequence range.....50/60Hz (47 to 63 Hz)
Power consumption.....200 VA (when no load input)
Maximum regenerated power.....5600 VA
Power regeneration efficiency.....85 % or more(at rated load power)
■ Protection function
DC side.....Overvoltage protection (OVP), Overcurrent protection(OCP), Overpower protection (OPP), Overheat protection (OHP), Reverse connection protection (REV), Undervoltage protection (UVP)
AC side.....Abnormal voltage range, Abnormal frequency range, Open phase, Abnormal current
■ External Controls.....External voltage (0 to 10 V): CC/CR/CP control
External voltage (0 to 10 V): CV control
External resistance (0 to 10 kΩ): CC/CR/CP control
External resistance (0 to 10 kΩ): CV control
■ Monitor signal output.....V MON (voltage): 5 Vf.s/10 Vf.s (30 V range/60 V range)
I MON (Current): 10 Vf.s/5 Vf.s (30 V range/60 V range)
■ Status signal output.....LOAD ON/ALARM/RANGE
■ Communication interface.....Equipped GPIB, RS232C, USB as standard interface
■ Others.....Master-Slave parallel operation feature (up to 5 units for the same model)

Regeneration efficiency of PLZ6000R



Options

■ Parallel operation cable
PC01-PLZ-4W



■ Power cable
AC8-4P4M-M6C

Electronic Load (AC)

PCZ1000A

GPIB OPTION | RS-232C | DRIVERS

Dimensions / Weight

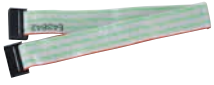
430(16.93″)W × 128(5.04″)H × 400(15.75″)Dmm(inch) /22kg(48.5 lbs)

Accessories

Operation Manual, AC power cable, Weight seal, Fuse in different rating(2 pcs.)

Options

■ Parallel operation cable
PC01-PCZ1000A



■ Sequence Creation Software
Wavy for PCZ1000A

For load test of inverters or transformers used for Fuel Cell, UPS, or Solar power generation

The PCZ1000A is an AC electronic load that enables you to perform the load simulation for various inverters* and transformers. In addition to the resistive loads generally used in tests, it is capable of simulating capacitor-input rectifier loads. The PCZ1000A supports input up to 1000 W and is equipped with 3 operation modes, Constant Current, Constant Resistance, and Constant Power. The current waveform resembles to sine wave can be output constantly without effect by voltage waveform at each mode. Moreover, the PCZ1000A is equipped with Crest Factor function suited to simulating current load test for switching power supply. This PCZ1000A provides improved operationality through CPU control and enables external control and read-back via RS232C interface.

*When the invertor circuit is used as the input source of this product, depending on the invertor waveform, it may cause a malfunction of the normal operation.
*Never connect the load input terminals to the AC power line directly.

Features

■ Crest Factor Function
Equipped with Crest Factor function that facilitates performing load tests for peak or harmonic currents
Crest Factor value can be set from 1.4 to 4.0

■ As master-slave control, up to 4 slave units can be connected in parallel. (Maximum 5 kW, 50 Arms)

■ Equipped with tracking operation function
Same setting value as that of master unit will be set on slave unit. It is convenient as a single-phase 3-wire or three-phase 3-wire AC source load

Specifications

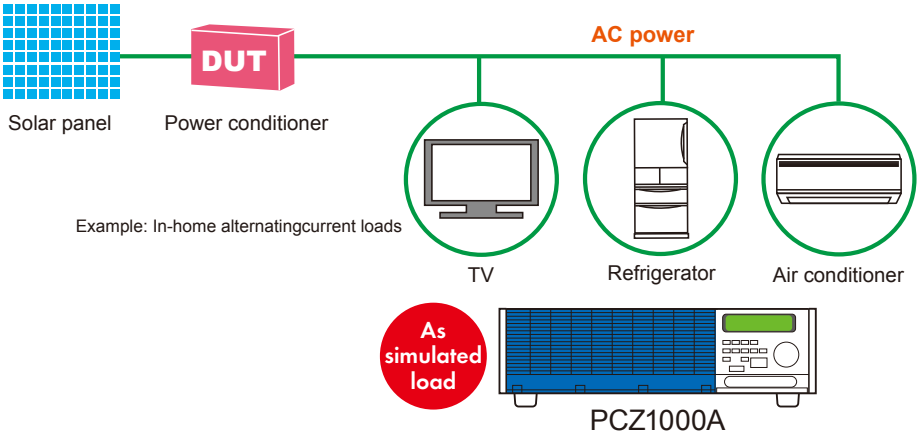
Input Rating						Constant Current mode		Constant Resistance mode				Constant Power mode
Operating Voltage		Maximum Current		Maximum Power	Frequency	Setting Range	Setting Resolution	Setting Range				Setting Range
Vrms	Vpeak	Arms	Apeak	W	Hz	Arms	mA rms	H range (full current at 10 V)		L range (full current at 100 V)		W
14 to 280	20 to 400	10	40	1000	45 to 65	0 to 10	10	1 to 1 kΩ	1 to 1 mS*	10 to 10 kΩ	0.1 to 0.1 mS*	50 to 1000

Crest Factor function		Input Power	Power consumption
Setting Range	Resolution	Voltage range	Approx.
		Vrms	VA
1.4 to 4.0	0.1	90 to 110/108 to 132/ 180 to 220/216 to250	220

*S represents unit of conductance (siemens)
Conductance[S]=1 / Resistance value[Ω]
Conductance[S]× Input voltage[V]=Load current[A]

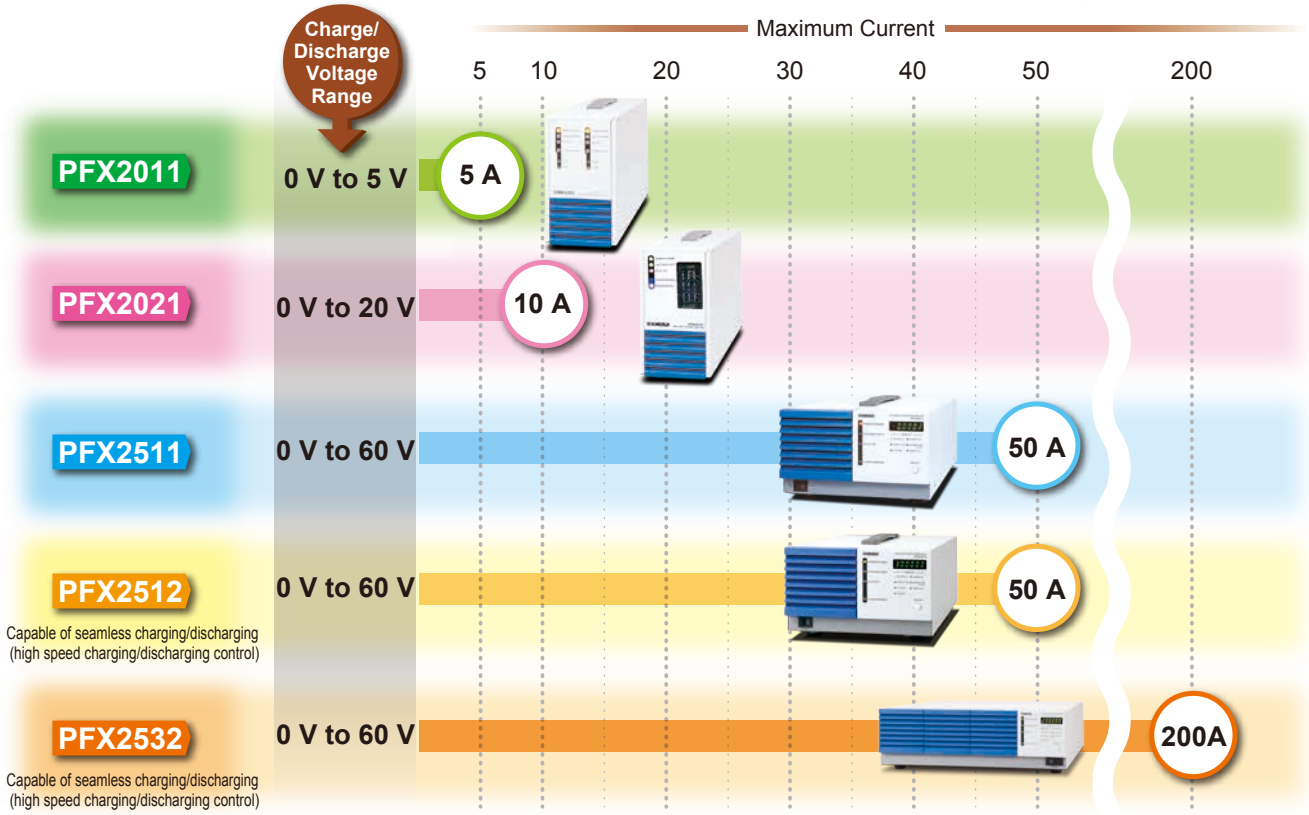
< example of use >

Use as a simulated load for a power conditioner grid connection test system.



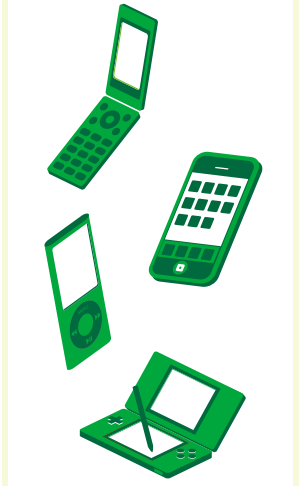
BATTERY TEST SYSTEM SELECTION GUIDE

PFX Series Charge/Discharge Voltage Range/Maximum Current



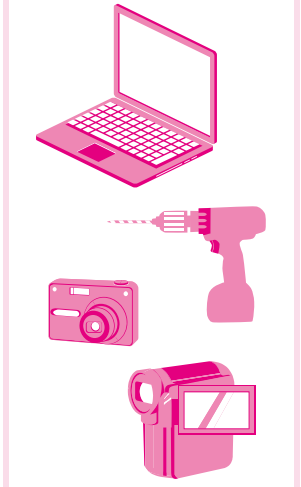
PFX Series Examples of Applications

PFX2011



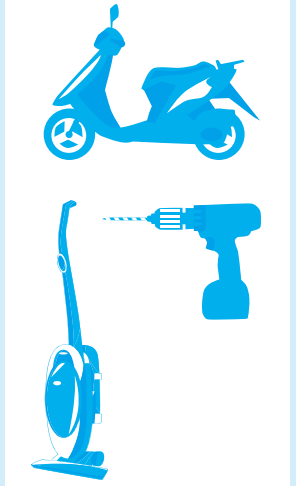
Examples:
- Mobile telephone
- Mobile music player
- Portable game console

PFX2021



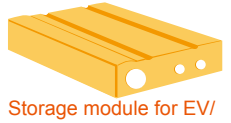
Examples:
- Notebook computer
- Video camera
- Digital camera

PFX2511



Examples:
- Electric motorcycle
- Power tools

PFX2512 PFX2532



Storage module for EV/ electric motorcycle

Storage module for server/home

Energy server (uninterruptible power supply)

Examples:
- Stationary/automotive lead-acid batteries
- Electric motorcycle

Charge/Discharage System

PFX2500 Series

LAN PFX2512 PFX2532 USB PFX2511 CE *Refer to page 8

Dimensions / Weight

PFX2511: 214.5(8.45″)W×124(4.88″)H×400(15.75″)Dmm(inch)/7 kg(15.43 lbs)
PFX2512: 214.5(8.45″)W×124(4.88″)H×400(15.75″)Dmm(inch)/7 kg(15.43 lbs)
PFX2532: 429.5(16.91″)W×128(5.04″)H×550(21.65″)Dmm(inch)/17 kg(37.48 lbs)

Accessories

Power cord, 26-core/20-core flat cable, Sensing connector, Thermistor, Lock lever, Operation manual,
PFX2511/PFX2512: Cable with crimp terminal, PFX2512: LAN cable(2m), PFX2511: Twisted-pair wire with TP-BUS connectors, TP-BUS core, BPChecker2000 setup guide, BPChecker2000 BASIC edition CD-ROM, PFX2532: I/O terminal cover set, I/O terminal M8 screw set, Load input terminal cover set, Ferrite core for 26-core/20-core flat cables, 26-core cable (with ferrite core) for PAT-T, Sensing connector cover set, LAN cable

Options

■ Load cable
TL08-PFX
Max.50 A, length:5 m Load cable with voltage current, and temperature sensing cable.


TL08-PFX

■ Sensing Cable Set
TL09-PFX (for OP01/02-PFX) approx. 5 m
TL11-PFX (for OP03-PFX) approx. 5 m
TL12-PFX* (for OP03-PFX) approx. 3 m


TL09-PFX

■ Cable Set
TL10-PFX* (for PFX2532)

■ Voltage/thermometer unit
OP01-PFX* (for PFX2511)
Up to 3 boards can be mounted
OP02-PFX* (for PFX2512/2532)
Up to 3 boards can be mounted


OP03-PFX

■ Voltage unit
OP03-PFX* (for SL01-PFX)
Up to 8 boards can be mounted

■ 8 Slot Unit
SL01-PFX* (for PFX2512/2532)


SL01-PFX

■ I/F cable
SC05-PFX (for PLZ-5W)
SC07-PFX (for PWR-01)


SC05-PFX


SC07-PFX

■ Application Software
SD002 (for PFX2511)
BPChecker2000 FULL Edition
(The 2-channel version is supplied with PFX2511)
SD007-PFX (for PFX2512/2532)
BPChecker3000

■ Rack mount frame
KRB3-TOS(EIA) (for PFX2532)
KRB150-TOS(JIS) (for PFX2532)
KRA3 (EIA)
KRA150 (JIS)

* The CE marked products

Fully support Charge and Discharge Measurement from Basic Test to Simulation Test

PFX2500 Series is a high performance Charge/Discharge system controller that takes measurements in combination with our DC power supply and electronic load in order to evaluate test sample (electric storage elements such as secondary batteries) characteristics. It is also capable of performing evaluation tests with high-performance, large capacity and a wide range of rating with the combination of DC power supply and electronic load.
Execution of the test is conducted by the exclusive application software. The test corresponds to long time continuous tests and synchronization test with temperature chambers with a multiplexed protection performance. In addition, easy data editing is also capable with a fulfilling graphic performance.

Features

- Capable of high-precision measurement of cumulative capacities and amount of power as well as voltage and current
- Pattern charging/discharging capabilities by 10000 steps are installed (for PFX2512, 2532)
- Supporting temperature measurement and capable of monitoring temperatures during charging/discharging
- Fully equipped with safety features of the overcharge protection using voltage, electric charge and temperature
- Battery deterioration is prevented by turning off the output after detecting wobbling and shock with vibration sensor
- Capable of seamless charging/discharging (high speed charging/discharging transfer control) (for PFX2512, 2532)
- High speed sampling with maximum 1 ms can be realized (for PFX2512, 2532)
- A 6 V range is newly installed and is capable of high-precision measurement (for PFX2512, 2532)
- LAN as standard equipment (for PFX2512, 2532)

The comparison of PFX2500 Series

Item	PFX2511	PFX2512	PFX2532
Rating	60 V / 50 A	60 V / 50 A	60 V / 200 A
Communication interface	TP-BUS (PFX2121 is required for PC connection)	LAN	
Monitoring data minimum time interval	1 s (up to 30 channels), 2 s (more than 30 channels)	0.1 s	
High speed data sampling	–	✓ (Selected form 1 ms/10 ms/ 100 ms maximum 6000 points for every profile)	
Charge/ discharge mode	6 modes Charging: CC, CC-CV Discharging: CC, CP, CC-Pulse, CP-Pulse	9 modes Charging: CC, CC-CV(Cell CV Voltage)*1 Discharging: CC, CP,CC-CV(Cell CV Voltage)*1, CP-CV(Cell CV Voltage)*1 Others: Pattern(CC, CP, Cell CV voltage*2), I-V, Pause	
Test condition configuration	Maximum 20 patterns are divided into individual loop setting and total repeat setting with charging and discharging as a pair.	Individual Profile Setting (unlimited) for Charging/Discharging, etc Conditional branching function from charge/discharge results is available.	
Seamless charge/ discharge	– (Approx. 2 seconds for charge/discharge transfer time: Depending on the number of channels)	✓ (Response within 50 ms (TYP)*3)	
Rest time control	Fixed time	The time variable by cell temperature	

*1 Can be set only when the optional OP02-PFX Volt/Thermometer Unit or OP03-PFX Voltmeter Unit is installed.
*2 Can be set only when the optional OP02-PFX Volt/Thermometer Unit or OP03-PFX Voltmeter Unit is installed. Step time can be used in more than 500 ms.
*3 It is defined as the time for the charge/discharge current to change from 10 % to 90 % of the preset value (ratedvalue).

Specifications

● Rated output

		PFX2511	PFX2512	PFX2532
Number of output		1 ch	1 ch	1 ch
Charging current range *1		0.000 A to 50.000 A	0.000 A to 50.000 A	0.000 A to 200.000 A
Charging voltage range *1	60 V range	0.000 V to 60.000 V	0.000 V to 60.000 V	0.000 V to 60.000 V
	6 V range	–	0.000 V to 6.000 V	0.000 V to 6.000 V
Discharge current range *1		0.000 A to 50.000 A	0.000 A to 50.000 A	0.000 A to 200.000 A
Discharge voltage range *1 *2	60 V range	0.000 V to 60.000 V	0.000 V to 60.000 V	0.000 V to 60.000 V
	6 V range	–	0.000 V to 6.000 V	0.000 V to 6.000 V

● Measurement accuracy

		PFX2511	PFX2512	PFX2532
Static				
Charge / discharge current measurement	Range	0.0000 A to 50.0000 A	0.0000 A to 50.0000 A	0.000 A to 200.000 A
	Accuracy *3	± (0.15 % of reading + 0.02 % of rating)	± (0.15 % of reading + 0.02 % of rating)	± (0.2 % of reading + 0.1 % of rating)
	Resolution	0.1 mA	0.1 mA	1 mA

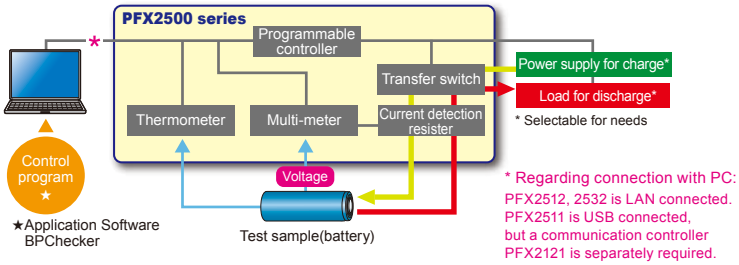
			PFX2511	PFX2512	PFX2532
Voltage measurement	Range	60 V range	-6.0000 V to 60.0000 V	-6.0000 V to 60.0000 V	-6.0000 V to 60.0000 V
		6 V range	–	-1.0000 V to 6.0000 V	-1.0000 V to 6.0000 V
	Accuracy *3	60 V range	± (0.05 % of reading + 0.02 % of rating)	± (0.05 % of reading + 0.02 % of rating)	± (0.05 % of reading + 0.02 % of rating)
		6 V range	–	± (0.05 % of reading + 0.04 % of rating)	± (0.05 % of reading + 0.04 % of rating)
	Resolution *4		0.1 mV	0.1 mV	0.1 mV
Power measurement	Range		–	0.000 W to 3000.000 W	0.0 W to 12000.0 W
	Accuracy		Software calculation (voltage measurement × current measurement)		
	Resolution		–	1 mW	100 mW
Capacity calculation	Range		0.000 Ah to 2000.000 Ah	0.000 Ah to 2000.000 Ah	0.000 Ah to 2000.000 Ah
	Accuracy		Rely on the current measuring accuracy and the time accuracy		
	Resolution		0.1 mAh	1 mAh	1 mAh
Time *5	Accuracy *3 *6		±10 ppm (TYP values)	±10 ppm (TYP values)	±10 ppm (TYP values)

*1. Range might be different depending on power supply to be connected, model of electronic load, wiring situation, etc. *2. Lowest dischargeable voltage might be different depending on electronic load model to be connected, wiring situation, etc. *3. Ambient temperature at 18 °C to 28 °C *4. Common with 6 V/60 V ranges *5. Accuracy of transit times (termination condition) at charge/discharge time and at rest. *6. Corresponding to 30 seconds of monthly difference.

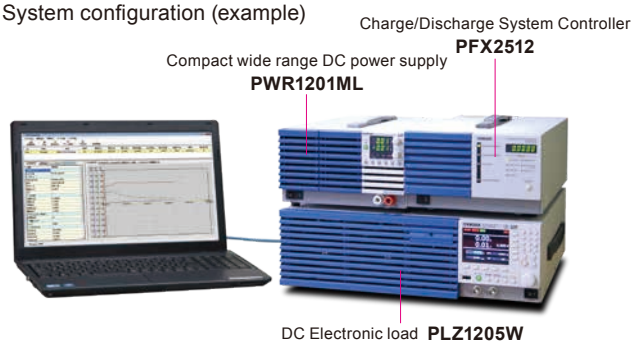
Complicated Systems Integrated into One

PFX2500 Series has integrated systems into one unit where battery evaluation is required. In addition, the series has high degrees of flexibility corresponding to a wide range of rating since it is possible to combine our conventional DC power supply (for charging) and our electronic load (for discharging) tailored to one's needs. Introduction cost is able to be reduced by selecting equipment which meets charge/discharge test condition requirements.

● System conceptual diagram



● System configuration (example)



[Applied configuration (model ID)]

Model ID is used for combination of the selected power supply and electronic load if you wish to have a combination that is not on the available model ID list, please consult with us. More model IDs will be added in future. The latest information for the system configuration is available on our website.

Model ID		Power supply for charge	Electronic load for discharge
PFX2511	PFX2512		
5103	7103	PWR1600L	PLZ1004W(2 units in parallel) *2
5105 *4	7105 *4	PAT60-67T	PLZ1004W+2000WB *1
5106	7106	PWR1600L	PLZ1004W *2
5107	7107	PAS10-70	PLZ1004W *2
5110	7110	PAS40-27	PLZ1004W *2
5112	7112	PAS10-35	PLZ334W *2
5119	7119	PWR1600L	PLZ1004W+2004WB *1
5122		PAS60-12	PLZ1004W *2
5125		PWR1600L	PLZ664WA *2
	7122	PAS60-12	PLZ664WA *2
	7124	PAS40-9	PLZ1004W *2
	7125	PWR1600L	PLZ664WA *2
	7126	PWR801L	PLZ1004W *2
	7127	PWR801ML	PLZ1004W *2
	7128	PWR1201ML	PLZ1004W *2
	7151	PWR401L	PLZ205W *2
	7152	PWR401ML	PLZ205W *2
	7153	PWR401L	PLZ405W *2
	7154	PWR401ML	PLZ405W *2
	7155	PWR801L	PLZ1205W *2
	7156	PWR801ML	PLZ1205W *2
	7157	PWR1201L	PLZ1205W *2
	7158	PWR1201ML	PLZ1205W *2
	7159	PWR1201ML	PLZ1205W(2 units in parallel) *2
	7160	PWR1201ML	PLZ1205W+2405WB *1

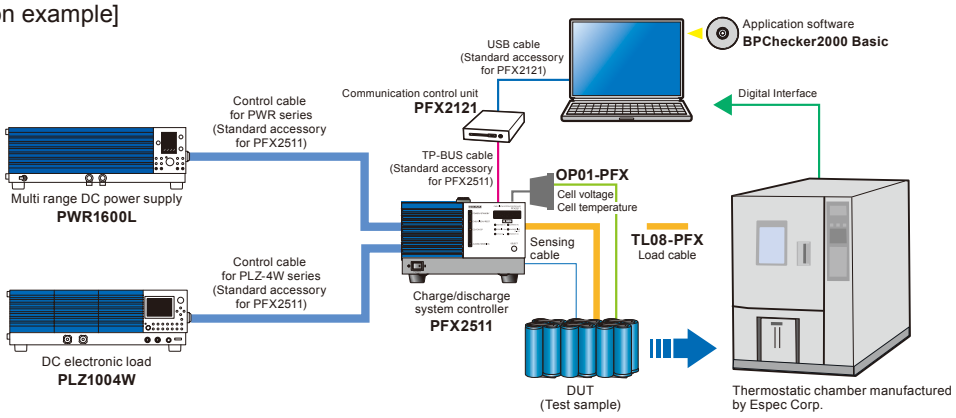
Model ID	Power supply for charge	Electronic load for discharge
PFX2532		
7301	PWR1600L (2 units in parallel)	PLZ1004W *2 +2004WB
7302	PAT60-133T	PLZ1004W *2 +2004WB x 2 (2 units in parallel) *3
7303	PAT40-200T	PLZ1004W *2 +2004WB x 2 (2 units in parallel) *3
7304	PAT40-200T	PLZ1004W *2 +2004WB
7305	PWR1600L	PLZ1004W *2
7306	PAT40-200T	PLZ1004W *2
7307	PWR1601L	PLZ1004W *2 x 2 (2 units in parallel)
7351	PWR1201L	PLZ1205W *2
7352	PWR1201L	PLZ1205W *2 x 2
7353	PAT60-133T	PLZ1205W *2 +2405WB x 2
7354	PAT40-200T	PLZ1205W *2
7355	PAT40-200T	PLZ1205W *2 +2405WB
7356	PAT40-200T	PLZ1205W *2 +2405WB x 2
7357	PAT40-200T	PLZ1205W *2 +2405WB x 3
7358	PAT40-200T	PLZ1205W *1 +2405WB x 4
7359	PAT80-100T	PLZ1205W *1 +2405WB x 4

*1. M range
*2. H range
*3. Can be replaced with the Kikusui SR Large Capacity Electronic Load Smart Rack System PLZ5004W.
*4. A separate cable is required. For details, contact your Kikusui agent or distributor.

* A SC07-PFX (optional) is necessary to connect the PWR-01 series with the PFX2500 series.
* A SC05-PFX (optional) is necessary to connect the PLZ-5W series with the PFX2500 series.

[2511 System Configuration example]

(model ID : 5106)



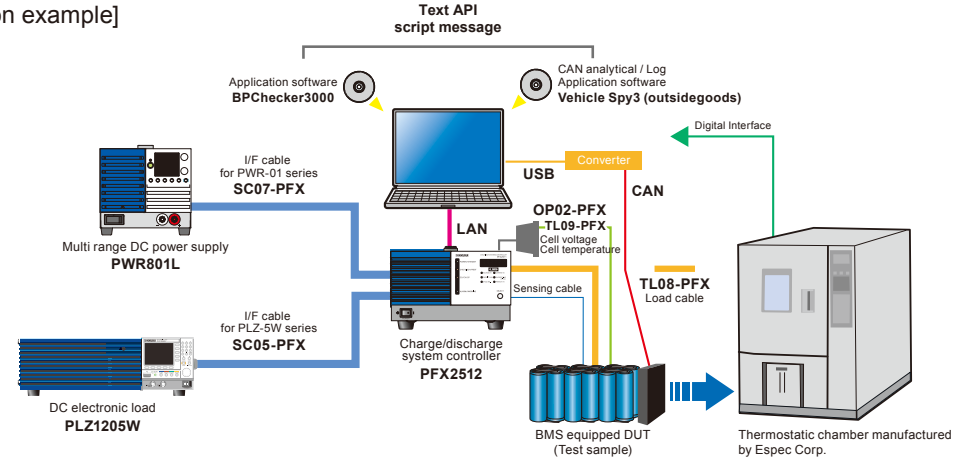
Comprehensive management from test condition setting to execution and data analysis on test results by PFX2511 exclusive application software, BPChecker2000 BASIC

The application software, BPChecker2000, can manage all processes from creating the test condition file to output of the test result file. Setting and execution of conditions for battery charge and discharge characteristics test and an analysis of test results can be performed on the PC. In addition, in an environment where an RS485-USB (or RS232C) converter can be controlled, it can externally control the temperature chambers manufactured by ESPEC, and it allows to synchronize with the temperatures in the chamber.

* The control of BPChecker2000 BASIC supplied with PFX2511 is limited to 2 channels. BPChecker2000 FULL Edition with no function limit is sold separately.

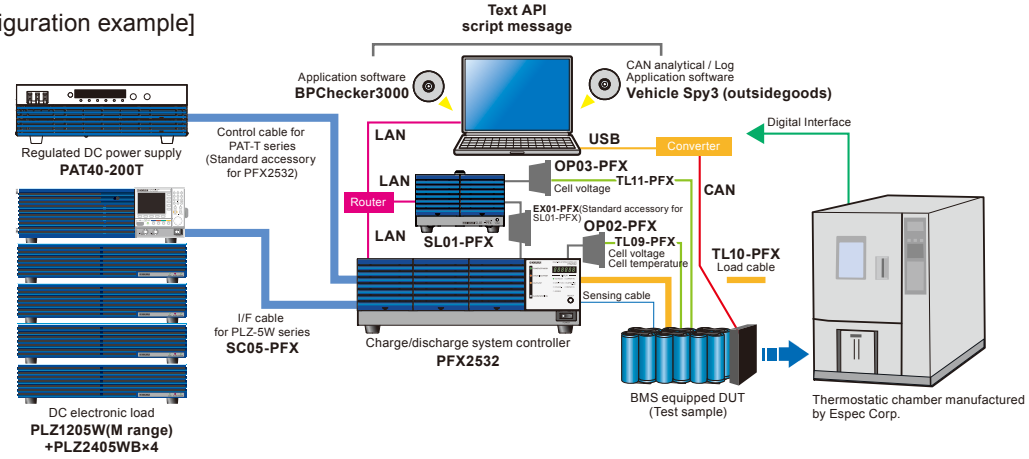
[2512 System Configuration example]

(model ID : 7155)



[2532 System Configuration example]

(model ID : 7358)



Comprehensive management from test condition setting to execution and data analysis on test results by PFX2512, 2532 exclusive application software, BPChecker3000

The application software, BPChecker3000 (SD007-PFX), is the new capability of PFX2512, 2532 where test condition and graphical drawing function are emphasized on existing BPChecker2000. This is the PFX2512, 2532 exclusive application software which realized [Seamless Charge/Discharge] and [High Speed Data Sampling]. At the test condition setting, the test condition (project) is created from database compiled charge/discharge condition (profile). The test execution shows that graphical display function is emphasized in its extraction and overwriting functions for larger data integration. In addition, synchronization operation with temperature chambers is capable and the charge/discharge test is comprehensively controlled including temperature control under test environment. furthermore, correspondence will also be capable of working together with [CAN Bus] for which demand will be increased accompanied by the technical development of battery management in future.

Battery Test System

PFX2000 Series

USB

This photo shows a 5-unit frame (PFX2332) housing 5 charging/discharging power supply units (3 PFX2011 units and 2 PFX2021 units) combined with an impedance measurement unit (PFX2211).

Dimensions / Weight

PFX2332: 442(17.4″)W × 177(6.97″)H × 550(21.65″)Dmm(inch) / 13kg(28.66 lbs)
PFX2121: 107(4.21″)W × 34(1.34″)H × 130(5.12″)Dmm(inch) / 500g(1.1 lbs)
PFX2211: 430(16.93″)W × 44(1.73″)H × 270(10.63″)Dmm(inch) / 4kg(8.82 lbs)

Model	Product name	Weight
PFX2011*	Charging/discharging power supply unit (2 channels)	4 kg(8.82 lbs)
PFX2021	Charging/discharging power supply unit (1 channels)	4.5 kg(9.92 lbs)
PFX2332	5-unit frame	13 kg(28.66 lbs)
PFX2121	Control unit (max. 120 channels)	500 g(1.1 lbs)
PFX2211	Impedance measurement unit	4 kg(8.82 lbs)
SD002	Application software BPChecker	

*While Supplies Last

Specifications

Unit model name	PFX2011	PFX2021
Number of output channels	2	1
Charging current range	0.0 mA to 5000.0 mA (high range) 0.00 mA to 500.00 mA (low range)	0 mA to 10000 mA
Charging voltage range	0.0000 V to 5.0000 V	0 V to 20.000 V
Charging mode	CC/CC-CV/PWM pulse	
Discharging current range	0.0 mA to 5000.0 mA (high range) 0.00 mA to 500.00 mA (low range)	0 mA to 10000 mA
Discharging voltage range	-0.5000 V to 5.0000 V	-2.000 V to 20.000V
Maximum charging/discharging power	25.00 W	200.00 W
Discharging mode	CC/CP/CC 8-value pulse	CC/CP/CC 20-value pulse/ CP 20-value pulse
Measurement parameters	voltage/current/capacity/electric energy/ temperature/high voltage/low voltage	

● General Specifications(PFX2332)
• AC Rated Input
200 VAC to 240 VAC, 50 Hz to 60 Hz, Single phase
• Power Consumption
Rated Output: 4000 VA (At ratings 5 PFX2021 units (5ch) operation)
With No Load: 30 VA (When the unit frame is uninstalled)

Implementing sophisticated battery tests with ease… A highly flexible system can be built

The PFX2000 Series is a battery test system developed on the basis of the experience and know-how that we have amassed through implementing numerous custom-built battery evaluation systems. The product adopts a unit structure that houses charging/discharging power supply units (PFX2011 or PFX2021) inside a unit frame (PFX2332). This enables you to build your battery test system in varying scale, from a small-size system with a single cell to a large-size system consisting of up to 120 units (max. 240 channels when all the units are PFX2011), making it possible to support any number of channels necessary for the test. Also, PFX2000 offers high availability by allowing you to replace only the unit that needs maintenance and to continue the test without stopping the entire system (hot plug feature). Each channel is completely independent of one another and thus can be controlled under different test and timing conditions. In addition, a rich set of protection features (OVP, UVP, OHP, etc.) is supported to prevent the test material from being destroyed by a system malfunction or operation mistake.
[Notes] PFX2021 cannot be operated with the previous 5-unit frame model (PFX2331).

Features

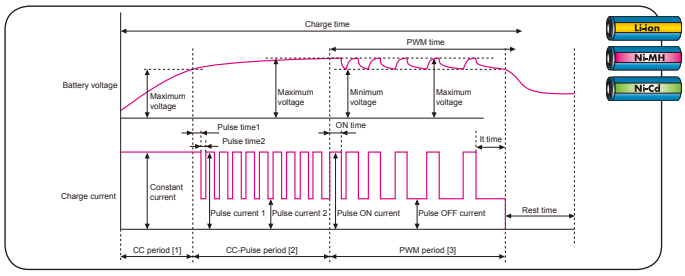
- CC pulse discharging mode intended for load patterns of cellular phones and other devices
- CP pulse discharging mode intended for load patterns of digital cameras and notebook PCs (PFX2021)
- Temperature measurement function
- Synchronized operation with thermostatic chamber
- Equipped with a V/F converter that ensures more accurate current measurement at pulse discharge (PFX2021)
- Power regeneration function (PFX2021)
- Expandable on a unit-by-unit basis
- Allows PFX2011 and PFX2021 to coexist in a single frame

Options

■ Impedance measurement cable
TL02-PFX (1 M)·····Cable length: 1 m
TL02-PFX (3 M)·····Cable length: 3 m
TL02-PFX (5 M)·····Cable length: 5 m
■ Load cable (7 m)
TL04-PFX·····Kit product for PFX2011
TL06-PFX·····Assembled product for PFX2011
TL05-PFX·····Kit product for PFX2021
TL07-PFX·····Assembled product for PFX2021

Example of Charging Mode

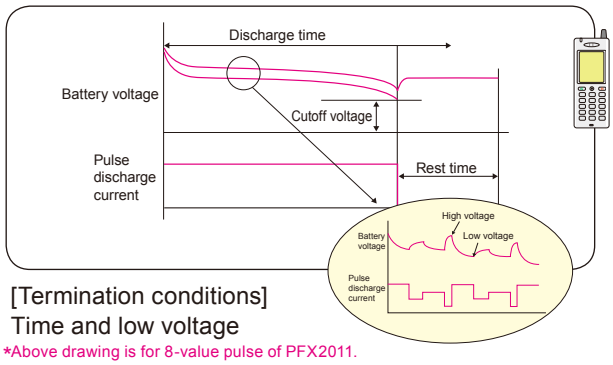
CC PWM (Constant current PWM pulse)



[Termination conditions]
Time and off time

Example of Discharging Mode

CC Pulse (Constant current 8-value/20-value pulse)*

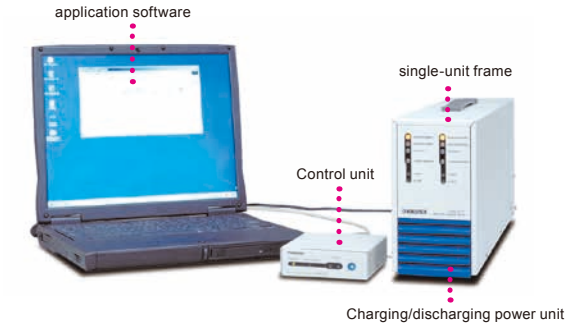


[Termination conditions]
Time and low voltage

*Above drawing is for 8-value pulse of PFX2011.
20-value pulse is applied for PFX2021.

Battery Test System <Basic Package>

PFX2000 Series Basic Package



Lineup

PFX2011: Basic Package [5 V-5 A/2 ch]
85.5(33.7″)W X 177(6.97″)H X 523(20.6″)Dmm(inch) / 4kg(8.81 lbs)

PFX2021: Basic Package [20 V-10A/1 ch]
85.5(33.7″)W X 177(6.97″)H X 523(20.6″)Dmm(inch) / 4.5kg(9.92 lbs)

All-in-one basic package to start battery test

PFX2000 Series Basic Package and Windows PC allow you to perform battery test such as PASS/FAIL diagnosis, lifetime test, and comparison evaluation for batteries.
PFX2000 Series is a high performance battery test system used by leading battery manufacturers. This system consists of the Charge/Discharge power supply unit installed in the exclusive design of the unit frame, a control unit PFX2121, an application software "SD002 BP Checker 2000 BASIC Edition", and necessary accessories such as cables. This basic package is capable to meet various types of charge and discharge testing for 2 channels.

Contents of the system

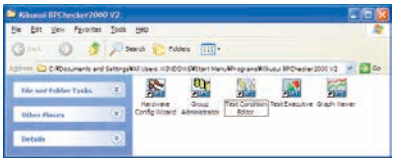
- Charge/Discharge power supply unit PFX2011 or 2021
- Control unit
- Unit frame for Charge/Discharge power supply unit
- Application software
- Accessories including alligator clip load cable

*PC is not included. Included application software "SD002 BPChecker2000 Basic Edition" is exclusive for 2CH operation. Impedance measurement cannot be done. Other specifications are same as "SD002 BPChecker2000 FULL Edition".
*This product is only for use with AC100 V input power. Please contact us if you require products which can be used with AC200 V power.

Application Software SD002 BPChecker2000

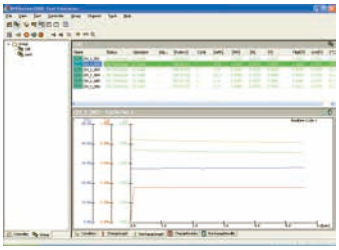
BPChecker2000 is an application software for the PFX2000 Series Charge/Discharge Battery System. BPChecker2000 enables you to set the conditions of the battery charge/discharge characteristics tests, execute the tests, and analyze the test results on a Personal Computer (PC).
This application software allows you to control two systems of PFX2121 120-ch Control Units via the USB port. This means that up to 240 charge/discharge power supply channels can be controlled simultaneously.
Furthermore, by adding a PFX2211 Impedance Measurement Unit, impedance can be measured up to 120 charge/discharge power supply channels that are connected to the control unit of the same system. Moreover, in an environment where an RS485-USB (or RS232C) converter can be controlled, thermostatic chamber (by Espec Corp.) can be controlled externally for synchronized testing.

● BPChecker2000 consists of the following five components.



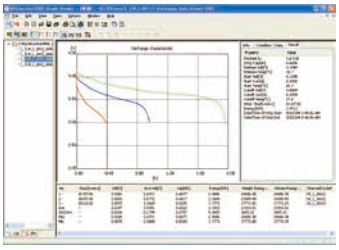
[Test Executive]

This application controls the execution of the test. It starts and stops the test and monitors the test execution. It provides a realtime graphical representation of the per-channel charging/discharging trends.



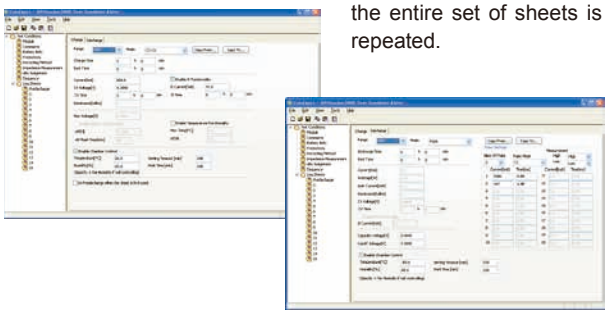
[Graph Viewer]

This application offers graphical representations of the charging/discharging data for each cycle. It can display up to 99 sets of data overlaid on one another in a single graph and perform statistical processing.



[Test Condition Editor]

A total of 15 sheets of test condition data can be set, with each sheet specifying both the charging and discharging conditions. It is also possible to set the number of times (repeats) that an individual sheet is to be repeated to form a particular charging/discharging cycle, as well as the number of times (loops) that the entire set of sheets is to be repeated.



[Hardware Configuration Wizard]

This is a program to detect the charge/discharge power supply units that are connected to the control unit and configure the connection environment with other hardware devices (Impedance measurement unit, Thermostatic chamber, etc.).

[Group Administrator]

This is a program to create/delete a group for performing tests.

Operating Environment for BPChecker2000

Windows XP(SP2 or later, x86), Windows Vista(x86/x64), Windows 7(x86/x64), Windows 8(x86/x64), USB port, and GPIB board that supports VISA library when thermostatic chamber control will be exerted.

Capacitor tester * While Supplies Last

PFX2400 Series

Dimensions / Weight

PFX2411: 430(16.93″)W × 195(7.68″)H × 410(16.14″)Dmm(inch) / 23kg(50.71 lbs)
PFX2421: 430(16.93″)W × 173(6.81″)H × 520(20.47″)Dmm(inch) / 27kg(59.52 lbs)
PFX2431: 430(16.93″)W × 173(6.81″)H × 520(20.47″)Dmm(inch) / 26kg(57.32 lbs)
PFX2441: 430(16.93″)W × 173(6.81″)H × 520(20.47″)Dmm(inch) / 26kg(57.32 lbs)

Accessories

Operation manual, Power cord
PFX2411: OUTPUT connector
PFX2421: OUTPUT terminal cover, M8/M4 output terminal screw
PFX2431: OUTPUT terminal cover, M8/M4 output terminal screw, Sensing connector
PFX2441: OUTPUT terminal cover, M8/M4 output terminal screw, Sensing connector

Lineup

Model	Applications	Voltage / Current / Power
PFX2411	Electric Double Layer Capacitors	5 V/5 A 25 W × 12 ch [300 W]
PFX2421	Electric Double Layer Capacitors	5 V/35 A 175 W × 4 ch [700 W]
PFX2431	The high-capacity Electric Double Layer Capacitors	5 V/70 A 350 W × 2 ch [700 W]
PFX2441	The high-capacity Electric Double Layer Capacitors	5 V/140 A 700 W × 1 ch [700 W]

Options

■ Load cable
TL20-PFX (for PFX2411)
TL21-PFX (for PFX2421)
TL22-PFX (for PFX2431)

■ Application Software
SD008-PFX2400

■ Rack mount brackets
KRB200 (for JIS inch size)
KRB4 (for EIA inch size)


TL20-PFX


TL21-PFX

Compliant with JIS D1401!
For EDLC (Electric Double Layer Capacitor) test

The Capacitor Tester PFX2400 Series is dedicated to design charge/discharge testers for electric double layer capacitors. The voltage rating is 5 V, targeting single-cell batteries, and a lineup of 4 models is available: 5 A/12-ch, 35 A/4-ch, 70 A/2-ch, and 140 A/1-ch.
In recent years, the electric double layer capacitor has been increasing its capacity, and it can be used in electric automobiles as power sources for starting the engine and for assistance during acceleration. Wider use of these capacitors is expected as a new energy source for raising automobile fuel economy and also improving exhaust quality. The Capacitor Tester PFX 2400 Series meets the need for more advanced and specialized tests related to the two key issues facing the wider use of electric double layer capacitors: power storage technologies and power management (energy optimization).

Features

■ Tester for EDLC (Electric Double Layer Capacitor) test
■ Fully independent channel operations
■ Setting operation and data collection by LAN
■ Capable of measuring voltage of reference electrode
■ Centralized management by dedicated application software
■ Data sampling at 1 ms or 100 ms

Specifications

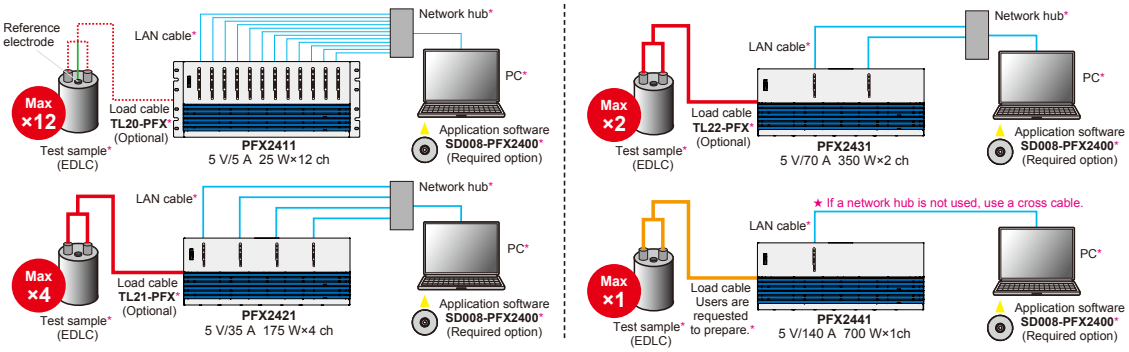
Model		PFX2411	PFX2421	PFX2431	PFX2441
Setting accuracy					
Current setting	Range	0.0000 A to 5.0000 A	0.000 A to 35.000 A	0.00 A to 70.00 A	0.00 A to 140.00 A
	Accuracy	± (0.07 % of set + 1 mA)	± (0.15 % of set + 15 mA)	± (0.15 % of set + 30 mA)	± (0.15 % of set + 60 mA)
	Resolution	100 µA	1 mA	10 mA	10 mA
	Ripple *1	1.5 mArms or less	20 mArms or less	40 mArms or less	60 mArms or less
Voltage setting	Range	0.0000 V to 5.0000 V			
	Accuracy *2	± (0.07 % of set + 1.5 mV)			
	Resolution	100 µV			
	Ripple *1	3 mVrms or less			
Power setting	Range	0.01 W to 25.00 W	0.1 W to 175.0 W	1 W to 350 W	1 W to 700 W
	Accuracy *3	± (0.1 % of set + 10 mW)	± (0.1 % of set + 100 mW)	± (0.1 % of set + 1 W)	± (0.1 % of set + 1 W)
	Resolution	10 mW	100 mW	1 W	1 W
Measurement accuracy					
Current measurement	Range	0.00000 A to 5.00000 A	0.000 A to 35.000 A	0.000 A to 70.000 A	0.000 A to 140.000 A
	Accuracy *4 *5	± (0.07 % of reading + 1 mA)	± (0.15 % of set + 15 mA)	± (0.15 % of set + 30 mA)	± (0.15 % of set + 60 mA)
	Resolution	10 µA	100 µA	1 mA	1 mA
	Sampling time	1 ms/100 ms			
Voltage measurement	Range	-0.50000 V to 5.00000 V			
	Accuracy *4 *5	± (0.07 % of reading + 1.5 mV)			
	Resolution	10 µV			
	Sampling time	1 ms/100 ms			
General specifications					
Nominal input rating		100 Vac to 240 Vac, 50 Hz/60 Hz			
Input voltage range		90 Vac to 250 Vac			
Power consumption		Per channel: Approx. 100 VA (when charged at 5 V, 5 A)	Per channel: Approx. 500 VA (when charged at 5 V, 35 A)	Per channel: Approx. 1000 VA (when charged at 5 V, 70 A)	2000 VAmax (when charged at 5 V, 140 A)
		For all 12 channels: 2000 VAmax (when all channels are charged at 5 V, 5 A)	For all 4 channels: 2000 VAmax (when all channels are charged at 5 V, 35 A)	For all 2 channels: 2000 VAmax (when all channels are charged at 5 V, 70 A)	

*1. 10 Hz to 500 kHz band *2. During charging *3. At a capacitor voltage of 0.5 V or higher
*4. Ambient temperature: 18 to 28 °C *5. Measurable range: The range indicated above

System configuration

Exclusive application software, SD008-PFX2400 is required to run the PFX2400 Series. For configuration of the system, in addition to the PFX2400 Series and SD008-PFX2400, you will need a PC, network hub, LAN cable and load cable (optional).

*Not included in the PFX2400 Series. They are optional, or users are requested to prepare them separately.

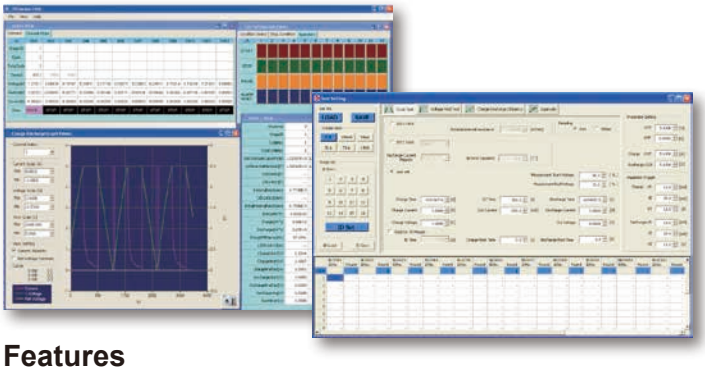


Application Software SD008-PFX2400

The SD008-PFX2400 package contains following three application software.

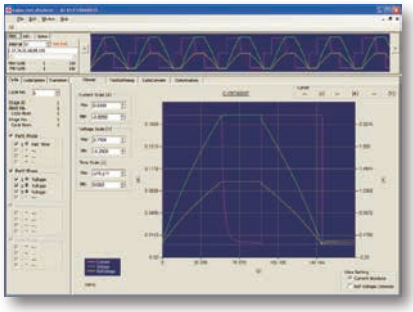
[CPChecker2400]

Using the PFX2400 series with this application software, you can create test conditions for the cycle test, voltage hold test and charge/discharge efficiency test and execute the tests.
An operation panel is provided independently for each channel, and an individual test per channel can be executed. For setting the test conditions, selections for JIS D 1401 and JIS C 5160 are provided. You can easily set the capacitor test conditions based on the JIS. The test results are saved in text files (CSV format), so they can be used with other spreadsheet software.



[CPChecker2400 Plus]

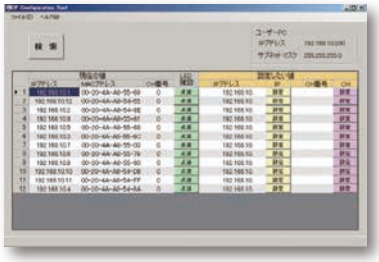
CPChecker 2400 Plus is software that graphs the test data that was created by CPChecker 2400 on the screen or printing. In addition to the test data graphs, it can also display the test data values, electrostatic capacities, and other values calculated from the test data, making a range of data analysis possible.



- Graph display and graph overlay for each test cycle
- Display of test data acquired with CPChecker 2400
- Display and printing of transition graphs for all cycles
- Recalculation of the initial internal resistance and internal resistance following changes to the calculation conditions

[IP Configuration Tool *2]

The IP Configuration Tool is to set the IP address and channel number of the Capacitor Tester PFX2411. The IP address*3 and channel number can be changed by this software.



► IP address: 192.168.0.0 to 192.168.255.254
► Channel number: 0 to 256

Features

- ■ Multi-channel control *1
- ■ Channel number assignment
- ■ Test condition configuration and saving
- ■ Test start, stop, pause, and alarm reset
- ■ Test result display
- ■ Test result file creation and saving (CSV format)
- ■ Measured value monitoring (charge and discharge current, terminal voltage, and reference electrode voltage)
- ■ HOVP/HUVP voltage display ■ Rest hold

*1 The number of channels that can be controlled varies depending on the data acquisition interval.For example, if a test cycle is 600 s, up to 96 channels can be controlled under the following conditions.
• △V: 0.5 % of the charge-discharge voltage • △I: 0.5 % of the charge-discharge current • △T: 10 s
The maximum number of 12 channels that can be displayed on the screen.

*2 When using only 1 unit of the PFX2400 series, IP Configuration Tool is not required.
*3 When IP Configuration Tool is not used, it is necessary to set the IP address and subnet mask of the personal computer with which CPChecker2400 is used according to the range of IP address of the PFX2400 series.

System requirements

■ CPChecker2400 and CPChecker2400 Plus

- PC running Microsoft Windows XP Service Pack 3 or later, Windows Vista, or Windows 7 or Windows 8
- Microsoft Windows Installer 3.1 (may need to be installed on Windows XP; included on the CD)
- Microsoft .NET Framework 3.5 SP1 (included on the CD)
- Microsoft Chart Controls for Microsoft .NET Framework 3.5 (included on the CD)
- 2 GB or more of memory
- Monitor with a resolution of 1280 x 1024 dots or higher
- 100 MB or more of free hard disk space (the amount of additional space that is needed depends on the type of data you need to save)
- CD-ROM drive • Mouse or other pointing device
- 10BASE-T or 100BASE-TX LAN port

■ IP Configuration Tool

- PC running Microsoft Windows XP Service Pack 3 or later, Windows Vista, or Windows 7 or Windows 8
- Microsoft Windows Installer 3.1 (may need to be installed on Windows XP; included on the CD)
- Microsoft .NET Framework 3.5 SP1 (included on the CD)
- 256 MB or more of memory
- Monitor with a resolution of 1024 x 768 dots or higher • CD-ROM drive
- Mouse or other pointing device • 10BASE-T or 100BASE-TX LAN port

■ Others

- LAN cables (the number of straight cables required is the number of PFX2400 channels that you want to use and one straight cable for the PC) *4
- Switching hub (the minimum number of ports required is the number of PFX2400 channels that you want to use and one port for the PC)
- PFX2400 Series
- Adobe Reader 6 or later (required to view the PDF version of the operation guide)

*4 If you only need to use one channel without a switching hub, you can connect the PFX2400 Series directly to a PC using a crossover LAN cable.

Fuel Cell Impedance Measurement System

KFM2150 system

USB GPIB RS232C

The KFM2150 cannot be operated alone. The operation of the KFM2150 system needs to be combined with PLZ-4W series and calibrated.

KFM2150 SYSTEM 1000-01
(The upper unit is an Fuel Cell impedance meter KFM2150, and the lower one is an electronic load unit PLZ1004W.)

Dimensions / Weight

KFM2150: 430(16.93″)W X 88(3.47″)H X 270(10.63″)Dmm(inch) / 6kg(13.23 lbs)
PLZ-4W Series: Refer to page 63.

● Bench top type(List of mass amount only)

KFM2150 SYSTEM 165-01A : 13.5 kg(29.76 lbs)
KFM2150 SYSTEM 660-01A : 22 kg(48.5 lbs)
KFM2150 SYSTEM 1320-02A: 38 kg(83.78 lbs)
KFM2150 SYSTEM 1000-01 : 21 kg(46.3 lbs)
KFM2150 SYSTEM 3000-02 : 45 kg(99.21 lbs)

● Rack mount type

KFM2150 SYSTEM 1980-03A: 570(22.44″)W X 1430(56.3″)H X 875(34.45″)Dmm(inch) / 170kg(374.8 lbs)
KFM2150 SYSTEM 2640-04A: 570(22.44″)W X 1430(56.3″)H X 875(34.45″)Dmm(inch) / 185kg(407.9 lbs)
KFM2150 SYSTEM 3300-05A: 570(22.44″)W X 1430(56.3″)H X 875(34.45″)Dmm(inch) / 200kg(440.9 lbs)
KFM2150 SYSTEM 5000-03 : 570(22.44″)W X 1430(56.3″)H X 1025(40.35″)Dmm(inch) / 190kg(418.9 lbs)
KFM2150 SYSTEM 7000-04 : 570(22.44″)W X 1430(56.3″)H X 1025(40.35″)Dmm(inch) / 215kg(474 lbs)
KFM2150 SYSTEM 9000-05 : 570(22.44″)W X 1430(56.3″)H X 1025(40.35″)Dmm(inch) / 240kg(529.1 lbs)

Impedance measurement system that supports stack fuel cells

The KFM2150 system is a fuel cell impedance measurement system configured with an Fuel Cell impedance meter KFM2150 and an electronic load PLZ-4W series. Combination of KFM2150 and PLZ-4WA series (0 V input type) supports impedance measurement for the single cell of fuel cell. In addition to impedance measurement with AC impedance method, KFM2150 system provides IR (internal resistance) measurement with a current interrupt method. Application software enables a test for each characteristic of fuel cell such as I-V characteristics, Constant Current characteristics, Current Interrupt method and Cole-Cole plot by the AC impedance method. Moreover, each test can be performed in a specified order.

Features

- Capable of measuring impedance in the frequency range from 10 mHz to 20 kHz
- Parallel operation can be configured with the same model of PLZ-4W series which enhances current capacity and power capacity
- Power capacity: 1000 W, 200 A, load input terminal: 1.5 V to 150 V (KFM2150 system 1000-01)
  660 W, 132 A, load input terminal: 0 V to 150 V (KFM2150 system 660-01A)
- Measuring AC current can be set from 0.1 % to 10 % (0.1% unit) of DC load current
- Capable of IR measurement with the current interrupt method
- Capable of varying DC load current while keeping measuring AC current setting (%)
- Equipped with low voltage protection
- Communication interfaces are equipped as standard (RS-232C, GPIB, USB)

Accessories

Operation Manual, CD-R(Contains the Communication Interface Manual and Application Software), Power cord, Sensing wire, Flat cable, RS-232C cable, Cables for parallel connection (2 pcs. per set./ KFM2150 SYSTEM 1320-02A, KFM2150 SYSTEM 3000-02 only)

Specifications

Model	Units configuring the system			Rating		
	Fuel Cell Impedance meter	Electronic load unit Operation mode: CC+CV mode	Type	Operating voltage V	Current A	Power W
KFM2150 SYSTEM 165-01A	KFM2150	PLZ164WA (1 unit)	Bench top type	0 to 150	33	165
KFM2150 SYSTEM 660-01A	KFM2150	PLZ664WA (1 unit)	Bench top type	0 to 150	132	660
KFM2150 SYSTEM 1320-02A	KFM2150	PLZ664WA (2 units)	Bench top type	0 to 150	264	1320
KFM2150 SYSTEM 1980-03A	KFM2150	PLZ664WA (3 units)	Rack mount type	0 to 150	396	1980
KFM2150 SYSTEM 2640-04A	KFM2150	PLZ664WA (4 units)	Rack mount type	0 to 150	528	2640
KFM2150 SYSTEM 3300-05A	KFM2150	PLZ664WA (5 units)	Rack mount type	0 to 150	660	3300
KFM2150 SYSTEM 1000-01	KFM2150	PLZ1004W (1 unit)	Bench top type	1.5 to 150	200	1000
KFM2150 SYSTEM 3000-02	KFM2150	PLZ1004W (1 unit)+PLZ2004WB (1 unit)	Bench top type	1.5 to 150	600	3000
KFM2150 SYSTEM 5000-03	KFM2150	PLZ1004W (1 unit)+PLZ2004WB (2 units)	Rack mount type	1.5 to 150	1000	5000
KFM2150 SYSTEM 7000-04	KFM2150	PLZ1004W (1 unit)+PLZ2004WB (3 units)	Rack mount type	1.5 to 150	1400	7000
KFM2150 SYSTEM 9000-05	KFM2150	PLZ1004W (1 unit)+PLZ2004WB (4 units)	Rack mount type	1.5 to 150	1800	9000

Model	Constant current mode			Ammeter			Constant voltage mode		Voltmeter		
	Allowable range (A)/Resolution (mA)			Accuracy*1			Allowable range (V) / Resolution (mV)		Accuracy*2		
	Range H	Range M	Range L	Range H (A)	Range M (A)	Range L (A)	15 V range	150 V range	10 V range (V)	100 V range (V)	150 V range (V)
KFM2150 SYSTEM 165-01A	0 to 33/1	0 to 3.3/0.1	0 to 0.33/0.01	0.0000 to 33.000	0.0000 to 3.3000	0.0000 to 0.3300	0 to 15.75/1	0 to 157.5/10	0.0000 to 9.9999	10.000 to 99.999	100.00 to 150.00
KFM2150 SYSTEM 660-01A	0 to 132/10	0 to 13.2/1	0 to 1.32/0.1	0.0000 to 132.00	0.0000 to 13.200	0.0000 to 1.3200					
KFM2150 SYSTEM 1320-02A	0 to 264/20	0 to 26.4/2	0 to 2.64/0.2	0.0000 to 264.00	0.0000 to 26.400	0.0000 to 2.6400					
KFM2150 SYSTEM 1980-03A	0 to 396/30	0 to 39.6/3	0 to 3.96/0.3	0.0000 to 396.00	0.0000 to 39.600	0.0000 to 3.9600					
KFM2150 SYSTEM 2640-04A	0 to 528/40	0 to 52.8/4	0 to 5.28/0.4	0.0000 to 528.00	0.0000 to 52.800	0.0000 to 5.2800					
KFM2150 SYSTEM 3300-05A	0 to 660/50	0 to 66/5	0 to 6.6/0.5	0.0000 to 660.00	0.0000 to 66.000	0.0000 to 6.6000					
KFM2150 SYSTEM 1000-01	0 to 200/10	0 to 20.0/1	0 to 2.00/0.1	0.0000 to 200.00	0.0000 to 20.000	0.0000 to 2.0000	0 to 15.75/1	0 to 157.5/10	0.0000 to 9.9999	10.000 to 99.999	100.00 to 150.00
KFM2150 SYSTEM 3000-02	0 to 600/30	0 to 60.0/3	0 to 6.00/0.3	0.0000 to 600.00	0.0000 to 60.000	0.0000 to 6.0000					
KFM2150 SYSTEM 5000-03	0 to 1000/50	0 to 100.0/5	0 to 10.00/0.5	0.0000 to 1000.0	0.0000 to 100.00	0.0000 to 10.000					
KFM2150 SYSTEM 7000-04	0 to 1400/70	0 to 140.0/7	0 to 14.00/0.7	0.0000 to 1400.0	0.0000 to 140.00	0.0000 to 14.000					
KFM2150 SYSTEM 9000-05	0 to 1800/90	0 to 180.0/9	0 to 18.00/0.9	0.0000 to 1800.0	0.0000 to 180.00	0.0000 to 18.000					

*1: Range H, M: ± (0.3 % of reading + 0.3 % of f.s), where f.s: full scale of the H range, Range L: ± (0.3 % of reading + 0.3 % of f.s), where f.s: full scale of the L range
*2: All ranges: ± (0.1 % of reading + 0.1 % of range)

Common Specifications

Impedance measurement function
AC impedance method
- Frequency range: 10 mHz to 20 kHz
- Frequency resolution: 14 points/decade (1.00, 1.26, 1.58, 2.00, 2.51, 3.00, 3.16, 4.00, 5.00, 6.00, 6.30, 7.00, 8.00, and 9.00)
- Measurement range: 0.0001 mΩ to 9.9999 Ω, indicated in five digits.
- Measurement items: R, X, | Z |, *q*

Current interrupt method
- Measurement range: 0.0001 mΩ to 9.9999 Ω, indicated in five digits.
- Measurement item: IR (internal resistance)

External control interface: RS232C, GPIB, USB
Average setting: Moving average, 1 to 256 times
Protection function
- Low-voltage protection (UVP): Turns the load off at –2 V to 150 V (settable). Issues an alarm signal.
- Load protection: Turns the load off upon receiving an alarm signal from the PLZ-4W series unit. Issues an alarm.

Input voltage range: Bench top type: 90 VAC to 250 VAC, single phase
Rack mount type: 180 VAC to 250 VAC, single phase
Input frequency range: 47 Hz to 63 Hz
Power consumption: 550 VA (SYSTEM165-01A)
1600 VA (SYSTEM660-01A)
3100 VA (SYSTEM1320-02A)
260 VA (SYSTEM1000-01)
460 VA (SYSTEM3000-02)
4600 VA (SYSTEM1980-03A)
6100 VA (SYSTEM2640-04A)
7600 VA (SYSTEM3300-05A)
660 VA (SYSTEM5000-03)
860 VA (SYSTEM7000-04)
1060 VA (SYSTEM9000-05)

Options

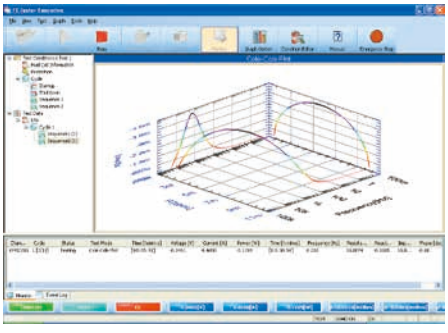
■ Rack mount bracket
KRB100-TOS (JIS standard)
KRB2-TOS (EIA standard)

“FCTester” (Application software)

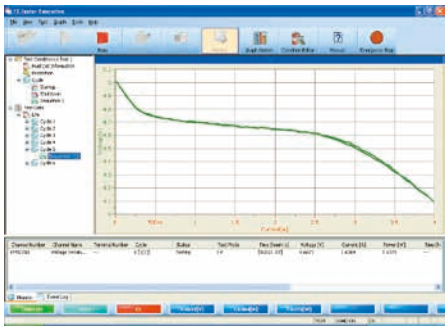
With the application software “FCTester”, the KFM system will be controlled by a PC and it offers the test for each characteristic of the fuel cell such as I-V characteristics, constant current characteristics, current interrupt method and Cole-Cole plot by the AC impedance method. In addition, each test can be performed in a specified order. Furthermore, it offers the sequential measurement of each cell's impedance by switching them off with the Fuel Cell Scanner KFM2151.

Features

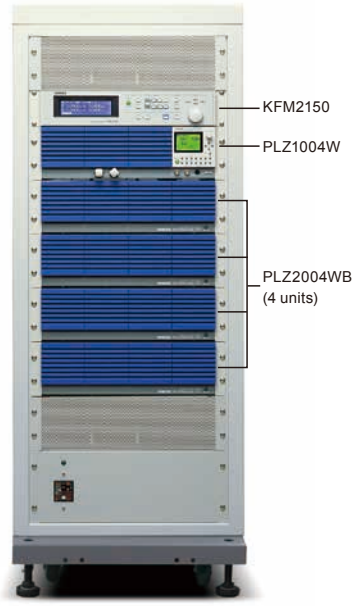
- ■ Fuel cell-friendly start-up and shut-down sequences are equipped.
- ■ Test modes such as I-V characteristics, constant current characteristics, current interrupt method, and Cole-Cole plot by the AC impedance method are equipped.
- ■ Capable of performing cycle test for fuel cell with a combination of sequence functions.
- ■ 2D/3D real-time graph function is equipped.
- ■ Capable of outputting the test data by CSV file (text format).
- ■ Capable of observing the voltage and the current waveform of when performing the current interrupt method.
- ■ A panel control function that is operable by PC equivalent to KFM2150’s panel operation is equipped.
- ■ Capable of performing the impedance measurement of each cell with a combination with the Fuel Cell Scanner (KFM2151).
- ■ “FCTester” consists of 3 programs, Configuration Tool, Condition Editor and Executive.



▲ Cole-Cole plot



▲ I-V characteristics



KFM2150 SYSTEM 9000-05

Fuel Cell Scanner

KFM2151

RS232C

32 ch voltage scanner that is compatible with stack fuel cells.

A combination with KFM2150 allows the impedance measurement.

Fuel Cell Scanner KFM2151 has a 32 ch scanner that meets the needs of monitoring each cell while assessing the stack fuel cell. It is capable of up to 160 ch in a parallel connection so that the scanner is compatible with various sizes of stacks. In order to remove the burden of connecting the lines, the scanner has a function to change the allocated terminal of the channel without reconnecting them when performing voltage and impedance measurement of arbitrary cells. It also features the 32 channels/sec. of the scanning speed that is sufficient enough for the practical use as the voltage monitoring function.

Dimensions / Weight

430(16.93″)W × 44(1.73″)H × 270(10.63″)Dmm(inch) / 3.5kg(7.72 lbs)

Accessories

Operation manual, Power cord, Metal fitting (4 pcs.), Metal fitting screws (4 pcs.), KFM2150 connection cable (1 m), Screwless terminal connector (8 poles, 8pcs.), Screwless terminal connector (2 poles, 2 pcs.)

Options

■ Rack mount bracket

KRB1-KFM(Compatible with the Inch rack EIA standard and the milli rack JIS standard)

■ Channel expansion cable

91-80-9901(Used when extended connection)

Features

- ■ Capable of impedance measurement that is up to 150 V of input voltage when connected to KFM2150 with the dedicated cable
- ■ Capable of 32 ch/unit input, and it is expandable to 160 ch in a parallel connection
- ■ Capable of voltage and impedance measurement of arbitrary cells in a single connection due to the function that allows the ability to change the allocated terminal of the channel
- ■ Capable of setting OVP and UVP to each channel
- ■ Capable of voltage monitoring with the 32 channels/sec. of the scanning speed
- ■ Capable of an individual operation as voltage monitoring

Specifications

SENSING terminal
- Number of inputs: 32 ch/unit (expandable to 160 ch with 5 units)
- Rated input voltage: ±150 V (±200 Vpeak maximum)

Interface
- Remote control: RS-232C
- For connecting the Fuel Cell Impedance Meter: Dedicated interface
- For channel expansion: Dedicated interface

Voltage measurement section
- Number of channels: 32. A SENSING terminal can be assigned to each channel.
- Range: 2 V, 20 V, 200 V, and auto range
- Scanning speed: 32 channels/s
- OVP: –2 V to 200 V. Can be set for each channel. Resolution: 0.01 V
- UVP: –2 V to 200 V. Can be set for each channel. Resolution: 0.01 V
- Voltmeter: Maximum display: 19999 Accuracy: ±(0.1 % of reading+ 0.1 % of range)

Impedance measurement switching section
- Number of channels: 32. A SENSING terminal can be assigned to each channel.
- Output terminal: Number of outputs: 1 ch Output voltage: Input voltage × 1/10 Accuracy: ±1 %: For DC
- Scanning: Auto or manual
- Frequency characteristics (value to be added to the measurement accuracy of the KFM2150*): 126 Hz or less: 2 % 158 Hz to 3 kHz: 2 % 3.16 kHz to 9 kHz: 3 % 10 kHz to 20 kHz: 5 %

Input voltage range: 100 VAC to 240 VAC(90 VAC to 250 VAC), single phase

Input frequency range: 47 Hz to 63 Hz

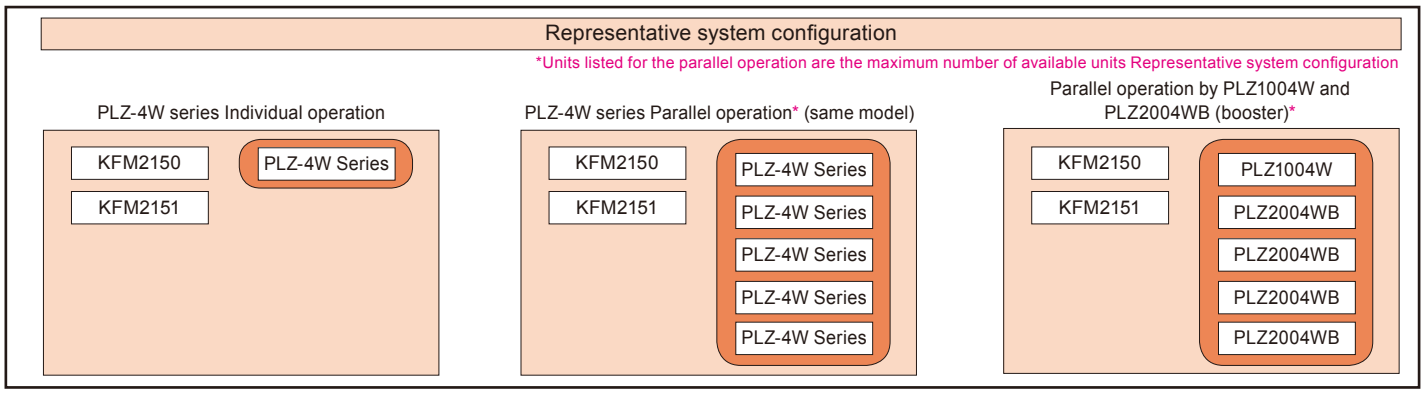
Maximum power consumption: 30 VAmax

Insulation resistance: 500 VDC, 30 MΩ or more (Between the primary circuit and chassis)

Withstand voltage: No abnormalities at 1500 VAC for 1 minute (Between the primary circuit and chassis)

*The basic measurement accuracy when combined with the KFM2150 Fuel Cell Impedance Meter is obtained by adding a percentage indicated for a specific frequency range to the percentage of the |Z| reading on the KFM2150. ±((percentage of the |Z| reading) + 3 mΩ) for the 10 mΩ range.

● Example of the impedance measurement system combined with KFM2150/KFM2151/PLZ-4W series (electronic loads devices)



Fuel Cell Impedance Meter

* While Supplies Last

KFM2005

USB GPIB RS232C DRIVERS

Dimensions / Weight

430(16.93″)W × 88(3.47″)H × 380(14.96″)Dmm(inch) / 9.5kg(20.94 lbs)

Accessories

Operation manual, Power cord, Sensing line, Load line,
CD-R(Contains Application Software)

Specifications

Impedance measurement part

Measurement frequency ..... 10 mHz to 10 kHz

Frequency resolution ..... 14 points/decade - 1.00, 1.26, 1.58, 2.00, 2.51, 3.00, 3.16, 4.00, 5.00, 6.00, 6.30, 7.00, 8.00, 9.00

Measurement range *1 ..... 16.5 mA range: 300 mΩ, 1 Ω, 3 Ω/AUTO, 50 mA range: 100 mΩ, 300 mΩ, 1 Ω/AUTO

Measurement alternated current ... 6 mArms ±10 % (16.5 mA range), 18 mArms ±10 % (50 mA range) Mechanically opens the AC current source

Measurement resolution ..... R,X,Z: 100 mΩ range: 0.0 mΩ to 999.9 mΩ, 1.000 Ω to approx.4.000 Ω; 300 mΩ range: 0.0 mΩ to 999.9 mΩ, 1.000 Ω to approx.12.000 Ω; 1 Ω range: 0.0 mΩ to 999.9 mΩ, 1.000 Ω to approx. 16.000 Ω; 3 Ω range: 0.000 Ω to approx.16.000 Ω; θ: All range: -180.00 deg to 180.00 deg

Measurement value display ..... Select and display 4 items among R, X, |Z|, θ, voltage, and current.

Measurement accuracy *2 *3 ..... 10 mHz to 900 Hz of R, X
± (2 % of | Z | reading +0.5 % of range +1 mΩ / variable ratio)
1 kHz to 4 kHz of R, X
±(3 % of | Z | reading +0.5 % of range +1.5 mΩ/variable ratio)
5 kHz to 10 kHz of R, X
± (4 % of | Z | reading +0.5 % of range +2 mΩ / variable ratio)

*1 Values up to four times of the range can be measured. If the measurement current varies, the allowable measurement value can be extended in proportion of the varied ratio. It can be varied up to ten times if the measurement current is set to 10 %. The maximum value can be set up to approx. 40 times of the range. *2 | Z | reading: reading value of "Z" range: measurement range variable ratio : variable ratio of measurement current (1 to 0.1) *3 after 32 times of moving average

Possible to acquire the Tafel plot and the Cole-cole plot of the micro fuel cell (such as cellular phones, laptop computers, and electric power-assisted bicycles, etc.)

The impedance meter KFM2005 is designed for testing the fuel cell with the small current (5 A or less), and not only the current-voltage characteristic test, the KFM2005 can easily measure the impedance of a fuel cell using the AC impedance method, and the Cole-Cole plot. Using the measurement data of the Cole-cole plot, it is possible to calculate the circuit constant of the approximate equivalent circuit of the fuel cell. The built-in DC load (60 W) is capable to operate from 0 V, and it can peform the test for the fuel cell up to 20 V and 5 A.

Features

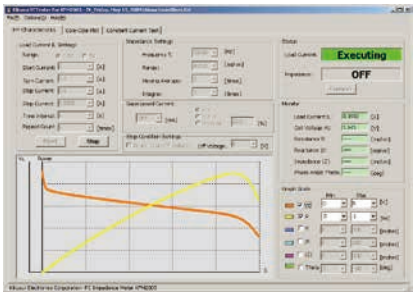
- Impedance of cells up to 20 V can be measured in the range of 10 mHz to 10 kHz.
  The cell voltage/current can be read back as well in the 0 V to 20 V/0 A to 5 A range.
- Impedance measurement
  The measurement AC current can be set for the range at 10 % to 100 % of each range of the rated value in 0.1 % step.
  Impedance measurement under condition of measurement AC voltage at 5 mV applied by the dummy constant voltage can also be set.
- Built-in electronic load offers two constant current mode ranges for the load rating: 5 A and 0.5 A
  Load current setting resolutions of 0.1 mA (5 A range) and 0.01 mA (0.5 A range), with maximum power consumption of 60 W.
- Equipped with “Undervoltage protection”, “Overvoltage protection”, “Overpower protection”, “Overheat protection”, “Overcurrent protection”, and “Line cut detection” as standard
- The backlit LCD offers enhanced visibility
- Four types of measurement value on the display can be chosen from R, X, |Z|, θ, voltage, and current
- Equipped with GPIB, RS232C and USB interfaces as standard
- Impedance measurements can be made in the range of 10 mHz to 10 kHz as well on both primary and secondary cells

Options

- Rack mount bracket
  KRB100-TOS (JIS standard)
  KRB2-TOS (EIA standard)

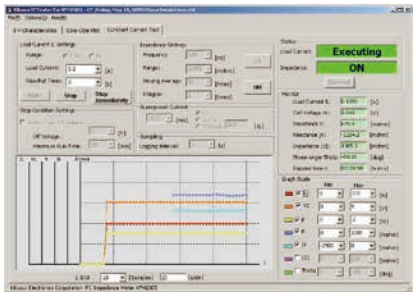
Application software

● The data acquisition of each characteristic test is possible by the application software included as a standard accessory.



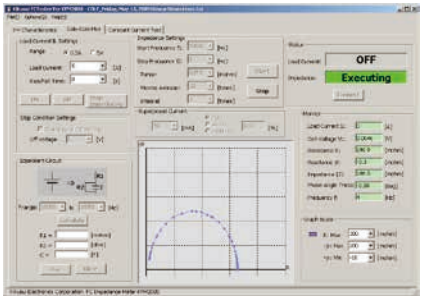
Current-voltage characteristic measurement testing (I-V characteristics)

It measures the voltage of the cell and internal resistance to the load current, and displays the Tafel plot. The load current can be increased or decreased with a maximum resolution of 10 µA.



Constant Current characteristic

The logging interval can be adjusted in the range of 1 s to 99999 s with a step of 1 s. At the same time, it is also possible to perform the impedance measurement with a single frequency.



Cole-Cole plot

Based on acquisition of the multipoint plot of the frequency, the value for the circuit constant of the approximate equivalent circuit of the fuel cell can be figured.

Fuel Cell Impedance Meter

* While Supplies Last

KFM2030

USB GPIB RS-232C DRIVERS

Dimensions / Weight

430(16.93″)W × 88(3.47″)H × 380(14.96″)Dmm(inch) / 9.5kg(20.94 lbs)

Accessories

User's Manual, CD-R(Contains the Communication Interface Manual and Application Software), Power cord, Sensing line, Load line

Options

■ Rack mount bracket
KRB100-TOS (JIS standard)
KRB2-TOS (EIA standard)

Application software

- Cole-Cole plot
- Current-voltage characteristic measurement testing (I-V characteristics)
- CC mode testing (for aging)

Fuel cell characteristic, variation, and service life testing can be done with ease!

The impedance meter KFM2030 is intended to enable the impedance characteristics of a fuel cell to be measured easily through the use of the AC impedance measurement method.
Using the application software that comes with it, the data acquisition is possible for the I-V characteristic, the Constant Current characteristic, and the Cole-Cole plot by using the AC impedance method. With a low-power DC load (60 W) built in it, KFM2030 supports fuel cell load testing up to 20 V and 30 A.

Features

- ■ Impedance of cells of up to 20 V can be measured in the range of 10 mHz to 10 kHz. (The cell voltage can be read back as well in the 0 V-20 V range.)
- ■ Two constant current mode ranges for the load rating: 30 A and 5 A Load current setting resolutions of 1 mA (30 A range) and 0.1 mA (5 A range) are available, with maximum power consumption of 60 W
- ■ Undervoltage protection, overvoltage protection, overpower protection, overheat protection, overcurrent protection, and line cut detection are supported
- ■ The backlit LCD offers enhanced visibility
- ■ Four types of measurement value can be chosen for display freely from R, X, |Z|, θ, voltage and current
- ■ Equipped with GPIB, RS232C and USB interfaces as standard
- ■ Impedance measurements can be made in the range of 10 mHz to 10 kHz as well on both primary and secondary cells

Specifications

Impedance measurement part
- Measurement frequency ..... 10 mHz to 10 kHz
- Frequency resolution ..... 14 points/decade - 1.00, 1.26, 1.58, 2.00, 2.51, 3.00, 3.16, 4.00, 5.00, 6.00, 6.30, 7.00, 8.00, 9.00
- Measurement range*1 ..... 165 mA range (60 mA AC rms): 30 mΩ, 100 mΩ, 300 mΩ, AUTO
  500 mA range (180 mA AC rms): 10 mΩ, 30 mΩ, 100 mΩ, AUTO
- Measurement alternate current .... 60 mA rms (165 mA range), 180 mA rms (500 mA range), OFF
- Measurement resolution ..... 10 mΩ range: 1 μΩ
  30 mΩ, 100 mΩ range: 10 μΩ
  300 mΩ range: 100 μΩ
- Measurement value display ..... Four types of measurement value can be chosen for display freely from R, X, | Z |, θ , voltage, and current.
- Measurement accuracy ..... 10 mHz to 900 Hz R, X: ±2 % of range
  1 kHz to 4 kHz R, X: ±3 % of range
  5 kHz to 10 kHz R, X: ±4 % of range

DC voltage/current measurement part
- Voltage range ..... Automatic switch between two ranges: 2 V and 20 V
- Voltage measurement resolution .... 2 V range: 100 μ V
  20 V range: 1 mV
- Voltage measurement accuracy .... 2 V range ±(0.2 % of reading + 6 digits)
  20 V range ±(0.7 % of reading + 8 digits)
- Current measurement resolution .... 1 mA
- Current measurement accuracy .. ±2 % for 30 A
- Monitor output (insulated output for the load) ..... Voltage monitor: Outputs 10 V for sensing input voltage of 20 V
  Voltage monitor accuracy: ±0.05 V
  Current monitor: Outputs 10 V for load current of 30 A.
  Current monitor accuracy: ±0.2 V

Electronic load
- Operation mode ..... Constant current
- Range ..... Two ranges - 5 A and 30 A
- Maximum load current ..... 30 A
- Input voltage range ..... 0 V to 20 V
- Maximum input power ..... 60 W
- Current setting accuracy ..... ±(0.5 % of set*2 +10 mA)
- External control*3 ..... 5 A range: 0 A to 5 A for 0 V to 10 V
  30 A range: 0 A to 30 A for 0 V to 10 V

Display(240 dots × 64 dots, LCD with Back light)
- Impedance measurement part ..... 10 mΩ → XX.XXX mΩ,
  30 mΩ/100 mΩ → XXX.XX mΩ
  300 mΩ → XXX.X mΩ
- DC voltage measurement part ..... 0.0000 V to 2.0000 V and 2.000 V to 20.000 V

Average setting
- The integral average (1 to 32) and the moving average (1 to 256) may be used in combination.

Power
- Allowable power voltage range ..... 90 VAC to 132 VAC, 180 VAC to 250 VAC, Single phase
- Power frequency range ..... 45 Hz to 65 Hz
- Maximum power consumption ..... 600 VA or less
- Dielectric resistance ..... 50 MΩ or more (500 VDC)
  [between AC line and chassis]
- Withstand voltage ..... 1500 VAC/minute
  [between AC line and chassis]

*1. Values up to four times the range can be measured. Note that, in cases where the drift or ripple of the fuel cell is large or there is much noise, a value lower than the range may be regarded as exceeding the range.
*2. set: Value set for input current
*3. The set full scale can be fine-tuned.

Precision DC Source

KDS6-0.2TR

GPIB RS232C DRIVERS

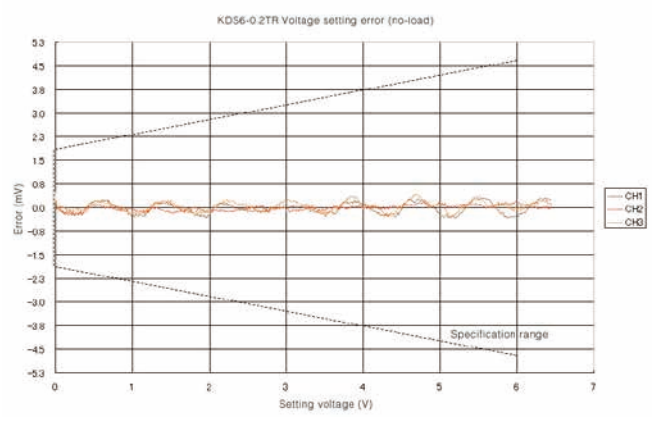
Dimensions / Weight

280(11.02″)W × 88(3.47″)H × 270(10.63″)Dmm(inch) / 4kg(8.82 lbs)

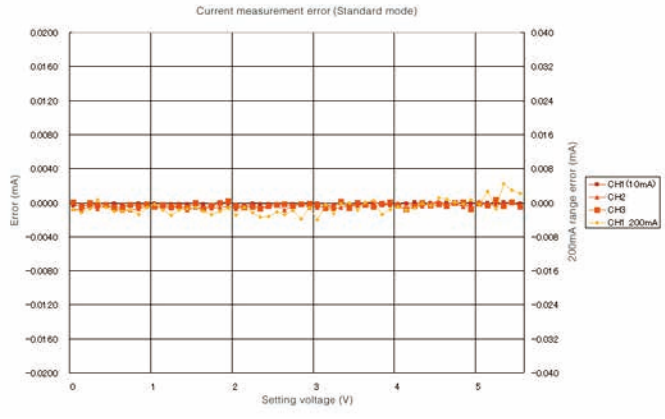
Accessories

Operation Manual, AC power cable, Fuse (1 set), Output connector (D-SUB 25 pin)

Examples of Setting Values



▲ Voltage setting error (no-load)



▲ Current measurement error (standard mode)

Suitable for evaluation tests of high-frequency electronic components and precision electronic circuits

KDS6-0.2TR is designed for use on production and inspection lines for high-frequency components capable of low supply current and low voltage operation that have become dominantly popular in recent years, as well as for a variety of electronic devices such as ICs, LSIs, and sensors. This product is a low-noise, highly stable DC voltage power supply with 3-channel output.

Features

- 3-channel voltage standard
  [CH1: 0 to +6 V/200 mA, CH2: 0 to +6 V/30 mA, CH3: 0 to +6 V/30 mA (COM of 3-channel in common)]
- Remote sensing function that compensates for voltage drops at the output terminal
- Best suited to operation tests for VCO and many other types of sensors
- Voltage setting resolution of 100 µV (allows a different voltage to be set independently for each channel)
- Current reading resolution of 0.1 µA* (in standard mode)
- Ripple noise level lower than 100 µVrms, thus supporting measurements of high-sensitivity devices
- High-resolution meter with an easy-to-view, 6-digit current display (no external ammeter needed)
- Supports RS-232C and GPIB as standard interfaces
- High-speed operation
  Current value refresh interval: 60 ms (in high-speed mode)
  Setting/readout speed: 5 ms (reference value for GPIB)
- Comes with a D-Sub 25 pin connector allowing for noise resistance

* 1 µA resolution for the 200 mA range

Specifications

Output voltage and current ranges	CH1: 0 V to +6 V at max. 200 mA CH2 & CH3: 0 V to +6 V at max. 30 mA
Output voltage setting resolution	100 µV
Output voltage setting accuracy	± (0.05 % of setting + 2 mV)
Output ripple noise	100 µVrms or less
Current display resolution	Standard mode: 0.1 µA (CH1: 1 µA for the 200 mA range only) High-speed mode: 1 µA (CH1: 10 µA for the 200 mA range only)
Current display accuracy	± (0.2 % of reading + 20 digits)
External interface	GPIB: Complies with IEEE Standard 488-1978. SH1, AH1, T6, TE0, L4, SR1, RL1, PP0, DC1, DT0, C0, E1 RS-232C: Connector (D-Sub connector with 9 rear pins), Baud rate (2400, 4800, 9600, 19200, 38400 bps), Data length (8 bits), Stop bit (1 bit), Parity bit (None), Flow control (XON/XOFF)
Operating temperature range	0 ˚C to 40 ˚C
Operating humidity range	20 % rh to 85 % rh (without condensation)
Rated warranty temperature range	23 ˚C ± 5 ˚C
Rated warranty humidity range	20 % rh to 85 % rh (without condensation)
Storage temperature range	-10 ˚C to 60 ˚C
Storage humidity range	90 % or lower rh (without condensation)
Input supply voltage range (AC 50 Hz/60 Hz)	When set to 100 V: 90 V to 110 V When set to 120 V: 104 V to 126 V When set to 220 V: 194 V to 236 V When set to 240 V: 207 V to 250 V
Power consumption	40 VA or less

Harmonic/Flicker Analyzer

KHA3000

USB GPIB RS232C

Dimensions / Weight

430(16.93″)W × 177(6.97″)H × 270(10.63″)Dmm(inch) / 10kg(22.05 lbs)

Accessories

Operation Manual, Power cord, jumper Connector for voltage input connection (with a dedicated screwdriver)

Options

■ Multi-outlet Unit
OT01-KHA

(Used for power cords having plugs as equipment under test [EUT]. Connects various types of plugs used in many countries and regions of the world to the KHA1000. This unit is designed to keep the internal impedance low so that the unit conforms to the condition of voltage drop (0.5 V or lower) due to wiring impedance of the measuring system as specified by IEC61000-4-7 [Ed2.0].)

■ Dedicated Application Software
SD006-KHA

The "SD006-KHA, Harmonics Analyzing Suite" can remotely control the "KHA3000, Harmonic/Flicker Analyzer" from the PC, and acquire the test result file of the harmonic current test. And it also can analyze the test result file. The LIN1020JF/3020JF can be also controlled remotely

■ Daily Pre-test Checker
OP02-KHAS(SPEC40425)

Capable of handling single-phase and three-phase equipment for tests exceeding 16 A of current

KHA3000, in addition to the complied standards and features of the KHA1000 (dedicated for single phase), is equipped for the harmonic and flicker compliance tests exceeding 16 A of the single-phase and three-phase equipment. With this unit alone, you can take highly accurate simultaneous three-phase measurements up to 40 A/phase[*1]. Furthermore, the KHA series is compliant with three measurement technique standards, the existing and the latest versions, so you can simply select to take measurements for the latest standard including interharmonics and for the conventional integral multiple harmonics without using any other device. It is possible to acquire the pass/fail judgment by using the KHA to conduct the onsite testing as per[*2] near by the large device, accordingly it can save the significant amount of time that applies to the standard compliant test. Of course, it supports the measurement of the single-phase device and for the standard compliance testing below 16A. In addition to the real-time display that can be used like an oscilloscope and FFT analyzer, the unit offers the real-time judgment of compliance with standards. Using this unit alone, you can judge test results and prepare result reports without the use of a PC. On top of that, you can easily set up a test system by combining KHA3000 with an AC power supply (PCR-LE Series) and a line impedance network (LIN3020JF).

*1: Measurement beyond 40 A/phase can be supported by firmware ver.2.00 or later of KHA3000,and clamp-on probe on shelves.
*2: It is required to use the application software "SD006-KHA" ("SD005-KHA" for the model KHA1000) when you wish to generate the report of the waveform verification for the "Class C equipment" (lighting equipments) complied to the IEC6100-3-2Ed4.0.

Features

- ■ Supports harmonic and flicker compliance testing of single-phase and three-phase equipment
- ■ Installed with the latest standards of both harmonic and flicker limits
- ■ No need for a PC for compliance testing
- ■ Real-time measurement that gives you a quick grasp of the EUT status
- ■ Assist function that guides you on standards and technical terms
- ■ Test reports available in both PDF and text formats

Specifications

● Common input specifications
Maximum input voltage ·· 600 Vrms/900 Vpeak (CAT I), 400 Vrms (CAT II)
Maximum input current .. 40 Arms/100 Apeak, whichever is smaller 160 Apeak (within 20 ms)
● Voltage measurement function
Rated voltage for the range·· 150 V/300 V/600 V
Allowable crest factor..... 2
Display item ..... TrueRMS/±peak
Accuracy..... ± (0.4 % of reading+0.04 % of range)
● Current measurement function
Rated current for the range.. 0.5 A, 1 A, 2 A, 5 A, 10 A, 20 A, 40 A
Allowable crest factor..... 4 (0.5 A to 20 A range)/2.5 (40 A range)
Accuracy ..... 45 Hz to 65 Hz
0.5 A range: ± (0.5 % of reading+0.2 % of range)
1 A to 40 A range: ± (0.5 % of reading+0.1 % of range)
66 Hz to 2.4 kHz
0.5 A range: ± ((0.5 + 0.417×n kHz) % of reading+0.2 % of range)
1 A to 40 A range: ± ((0.5 + 0.417×n kHz) % of reading+0.1 % of range)
● Power measurement function
Display item ..... Effective power, apparent power, reactive power, and power factor
Accuracy ..... P≧150 W (±1 % range), P<150 W (±1.5 W)
● Frequency measurement function
Measured frequency range/accuracy..45 Hz to 65 Hz/± (0.15 % of reading+2 digits)/0.001 Hz
● Harmonic current measurement function
Conforming standards.... IEC 61000-3-2 Ed4.0(2014), IEC 61000-3-2 Ed3.0(2005), IEC 61000-3-2 Ed2.2(2004), JIS C61000-3-2 (2005)(2011), IEC 61000-3-12 Ed1.0, JIS C61000-3-2, IEC 61000-3-12 Ed2.0,
Measuring instrument standard....IEC 61000-4-7 Ed2.1 (2009), IEC 61000-4-7 Ed2.0 (2002), IEC 61000-4-7 Ed1.0 (1991)
Harmonic analysis order... 40 th (HA mode), 180 (OTHER mode)
Interharmonics processing ...processing ON: IEC 61000-4-7 Ed2.1 (2009), IEC61000-4-7 Ed2.0 (2002)
processing OFF: IEC61000-4-7 Ed1.0 (1991)
Window function ..... Rectangular
Window width..... 10 cycles (50 Hz) 12 cycles (60 Hz), 16 cycles (50 Hz/60 Hz)
Anti-aliasing filter ..... Cutoff frequency: 6 kHz, 4 th Butterworth type (HA mode), 15 kHz 4 th Butterworth type (OTHER mode)
● Measurement power quality check function
Measurement items ..... Voltage, frequency, and voltage harmonic inclusion rate
Number of voltage harmonicorders analyzed.....40 th
● Flicker/voltage fluctuation analysis function
Conforming standards ... IEC 61000-3-3 Ed3.0(2013), IEC 61000-3-3 Ed2.0(2008),
.....IEC 61000-3-11 Ed1.0(2000)
Requirements for measuring instrument standard
..... IEC 61000-4-15 Ed2.0(2010), IEC 61000-4-15 Ed1.1(2003)
Flicker ..... Pst/Plt accuracy: 1±5 %
Pst observation time: 30 to 900 seconds
Voltage fluctuation ..... Observation method: It shall be possible to choose between measuring voltage fluctuation alone and measuring it along with Pst.
dmax measurement for manually operated equipment
..... 3 - 24 times (one measurement period ranging from 30 to 180 seconds)
● General-purpose measurement functions
..... Current/voltage waveform monitor, FFT analyzer, and In-rush current measurement
● Communication interface.. GPIB, RS232C, USB
● Removal data storage ... Supported media:
Compact flash memory card (CF card*2)/Maximum capacity: 512 MB
USB memory/Maximum capacity: 16GB
● External device control function.. PCR-LA control (RS-232C): Voltage, frequency,range, ON phase, OUTPUT ON and OFF
● Nominal voltage range... 100 VAC to 240 VAC 50/60 Hz 250 VA or less
● Operating temperature and humidity ranges
..... 0 ˚C to 40 ˚C, 20 % rh to 80 % rh (no condensation)
● Withstand voltage ..... 1500 VAC: one minute

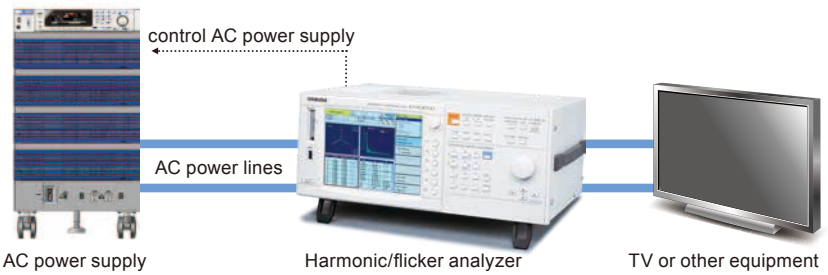
*2: Users are regulated to prepare CF cards

Complied standards (Testing can be done to verify compliance with the standards mentioned below.)

Category	Limit value standard/edition	Measurement technique standard/edition
Harmonic current	IEC 61000-3-2 Ed4.0(2014) [EN 61000-3-2 (2014)]	IEC 61000-4-7 Ed2.1(2009) [EN 61000-4-7(2002)/A1(2009)] IEC 61000-4-7 Ed2.0(2002) [EN 61000-4-7(2002)] IEC 61000-4-7Ed1.0(1991), [EN 61000-4-7(1993)]
	IEC 61000-3-2 Ed3.0(2005) [EN 61000-3-2 (2006)]	
	IEC 61000-3-2 Ed2.2(2004), [EN 61000-3-2 (2000)/A2(2005)]	
	JIS C61000-3-2 (2011), JIS C61000-3-2 (2005)	
	IEC 61000-3-12 Ed2.0(2011)	
	IEC 61000-3-12 Ed1.0(2004)	
Flicker/voltage fluctuation	IEC 61000-3-3 Ed3.0(2013) [EN 61000-3-3(2013)] IEC 61000-3-3 Ed2.0(2008) [EN 61000-3-3(2008)] IEC 61000-3-11 Ed1.0(2000)	IEC 61000-4-15 Ed2.0(2010) [EN 61000-4-15(2011)] IEC 61000-4-15 Ed1.1(2003) [EN 61000-4-15(1998)/A1(2003)]

Note: The Chinese Standard GB17625.1-2003 conforms to IEC61000-3-2:2001: thus, tests can be carried out using this unit by specifying the nominal voltage (220 V/380 V) for IEC61000-3-2 Ed2.2 For compliance with (EN61000-3-2: 2006/A1: 2009,EN61000-4-7: 2002/A1: 2009, EN61000-3-3: 2008), please consult with us.

■ Single-phase, two-line equipment measurement circuit compliant with harmonic standards (system configuration diagram/example)



System expansion

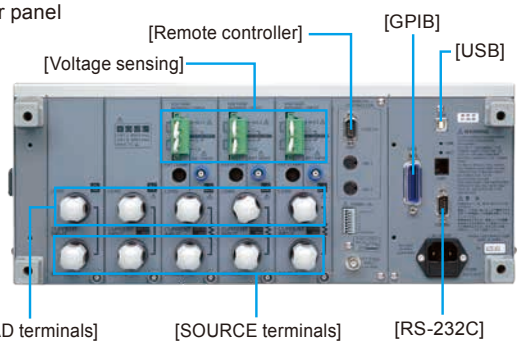
A line impedance network is required to perform compliance testing for voltage fluctuation and flicker standards. (The device is to be connected between the AC power supply and KHA3000.)

Line impedance network
LIN3020JF

User-friendly terminals and interfaces

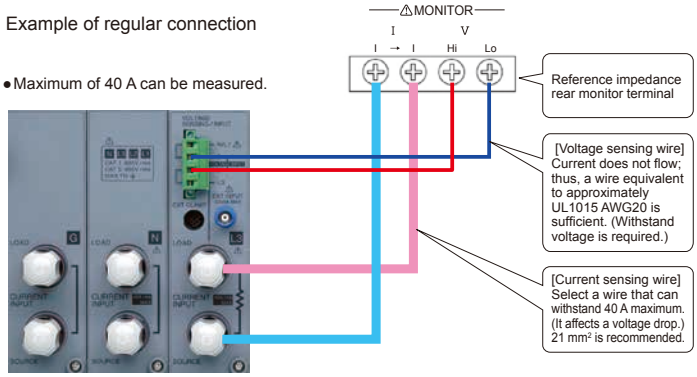
KHA3000 comes standard with GPIB, RS-232C and USB. SCPI commands make it possible to use the unit as a general-purpose power analyzer by connecting it to your computer.

■ Rear panel



Example of regular connection

●Maximum of 40 A can be measured.



●When replacing another manufacturer's power analyzer, connect as shown above. You can continue using the unit as before.
●If the power value is negative, switch the polarity of either the voltage or current sensing wire to fix it.

Harmonic/Flicker Analyzer

KHA1000

Harmonic and flicker analyzer compliant with the latest versions of the IEC and JIS standards

- ■ No need for a PC for compliance testing
- ■ Customization function to simplify time-consuming test condition setting
- ■ Real-time measurement that gives you a quick grasp of the EUT status
- ■ Assist function that guides you on standards and technical terms
- ■ CF card offering smooth interaction with a PC
- ■ Capable of measuring fundamental power source characteristics
- ■ Simplified connection systems with separated power supply input and load power
- ■ Test reports available in both PDF and text formats
- ■ Equipped with GPIB, RS-232C, and USB interfaces as standard
- ■ Dedicated application software SD005-KHA (optional)

Line Impedance Network

LIN Series

[LIN1020JF/LIN3020JF/OP01-LIN1020JF]

It is equipped with the IEC/JIS/JET standard impedance. It supports voltage fluctuation and flicker tests.

LIN3020JF►

■ LIN1020JF

LIN1020JF is equipped with the impedance determined by the IEC flicker test (IEC61000-3-3) and JIS harmonics (JIS C61000-3-2), which can be configured via the USB interface (standard feature) or the contact signal interface from the application software. The single-phase two-wire IEC flicker/harmonics test system can be configured in combination with AC power supply PCR-LE/LE2 and harmonic flicker analyzer KHA1000/KHA3000.

■ LIN3020JF

LIN3020JF is equipped with the impedance determined by the IEC flicker test (IEC61000-3-3) and JIS harmonics (JIS C61000-3-2), which can be configured via the USB interface (standard feature) or the contact signal interface from the application software. The single-phase two-wire/three-wire/three-phase IEC flicker/harmonics test systems can be configured in combination with AC power supply PCR-LE/LE2 and harmonics flicker analyzer KHA1000/KHA3000.

■ OP01-LIN1020JF

OP01-LIN1020JF is an additional unit that is used to expand LIN1020JF in three phases (addition of V phase and W phase).

* OP01-LIN1020JF does not work solely.

Model	Maximum current (per phase)	Wiring configuration	Complied standard			Remarks
			IEC 61000-3-3 230 V 50 Hz	JIS C61000-3-2 *1 JET GR0002-1-3.0		
				100 V 50/60 Hz	200 V 50/60 Hz	
LIN1020JF	20 A	Single phase 2-wire	✔	✔	✔	Product for IEC flicker / voltage fluctuation test *1 Insertion of the impedance is optional in the JIS harmonics test. (Normally applied for bypass.) *2 OP01-LIN1020JF does not work solely.
LIN3020JF		Single phase 2-wire/3-wire Three phase 3-wire/4-wire	✔	✔	✔	
LIN1020JF + OP01-LIN1020JF *2		Single phase 2-wire/3-wire Three phase 3-wire/4-wire	✔	✔	✔	
Impedance Value	Single phase 2-wire		0.4 Ω+Jn0.25 Ω(Z3)	0.4 Ω+0.37 mH(Z1)	0.38 Ω+0.46 mH(Z2)	
	Single phase 3-wire Three phase 3-wire Three phase 4-wire		0.24 Ω+Jn0.15 Ω (0.16 Ω+ Jn0.1Ω for N phase)	0.19 Ω+0.23 mH (0.21 Ω+ 0.14 mH for N phase)	0.19 Ω+0.23 mH (0.19 Ω+ 0.23 mH for N phase)	

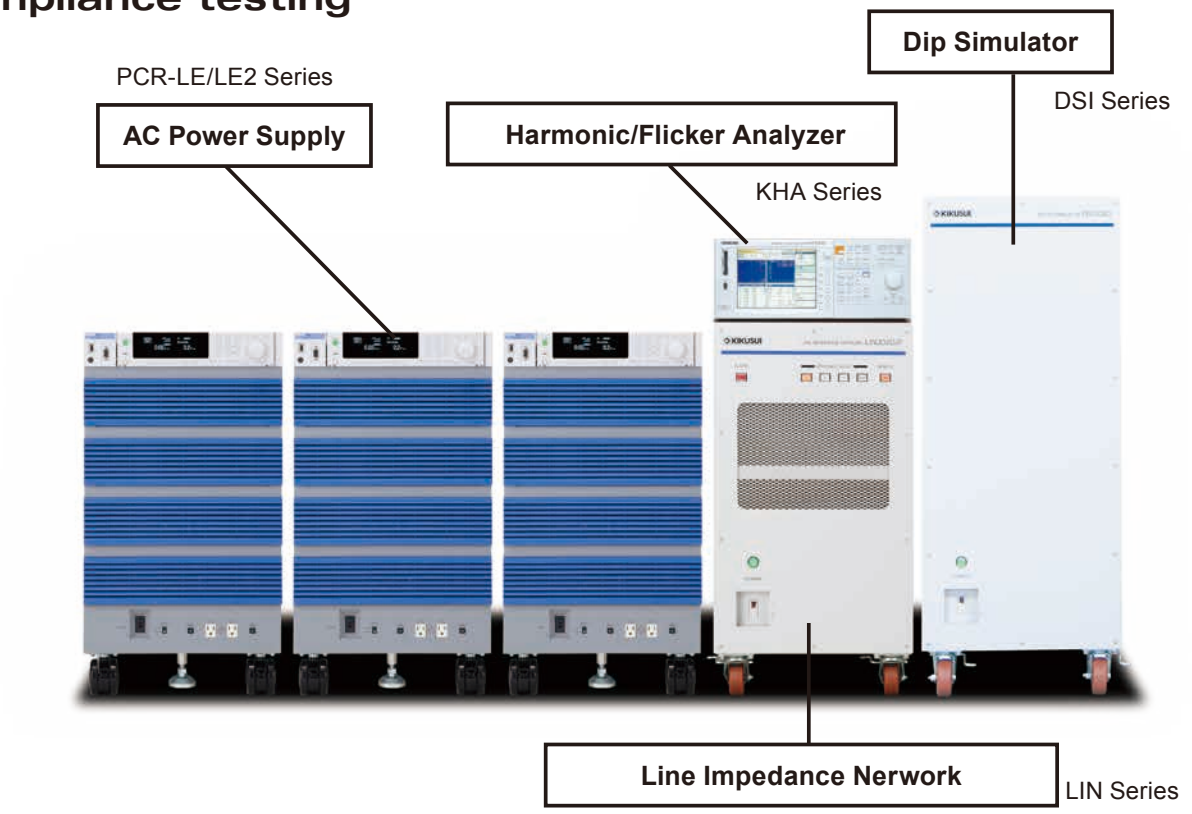
*This product is not designed to correspond to the PCR-L, PCR-LA series

IEC61000 Compliance Test System

[IEC61000-4 Series :Power Line Disturbance Immunity Testing System]

[IEC61000-3 Series :Harmonic Flicker Measurement Test System

New guideline to the low frequency EMC compliance testing



This system can simulate various conditions of phenomena occurring in AC power environments. It can be used for immunity tests of electrical and electronic devices which are connected to a low-voltage distribution system, or which have DC power input ports, under the standard conditions as specified on the right. The test conditions can be set outside the standard range, allowing the system to be used for preliminary tests prior to standard tests, immunity margin tests, and stress tests. The KHA3000 harmonic/flicker analyzer combines a PCR-LE Series AC power supply, LIN Series line impedance network, and application software, allowing tests which conform to IEC standards and JIS standards.

EMS Testing / EMI Measuring

EN/IEC 61000-4-11
EN/IEC 61000-4-13
EN/IEC 61000-4-14
EN/IEC 61000-4-17
EN/IEC 61000-4-27 (pre-compliance, 3-phase series only)
EN/IEC 61000-4-28
EN/IEC 61000-4-29 (pre-compliance)
EN/IEC 61000-4-34 (pre-compliance)

EN/IEC 61000-3-2
EN/IEC 61000-3-3
EN/IEC 61000-3-11
EN/IEC 61000-3-12
EN/IEC61851-21
ECE R10.04
ECE R10.05

Application Software

SD009-PCR-LE/SD011-PCR-LE
SD005-KHA/SD006-KHA

TOS SERIES SELECTION GUIDE

High-End Multi-type
Hipot, Insulation Resistance, Ground Bond, Leakage or

TOS9303LC P.96
AC/DC Hipot Tester with Insulation Resistance, Ground Bond, and Leakage Current Test

- ACW 5 kV/100 mA(500 VA)
- DCW 5 kV/20 mA,7.2 kV/13.9 mA(100 W)
- IR 0.001 MΩ to 100.0 GΩ (DC-25 V to -1000 V/DC+50 V to +7200 V)
- EC 0.001 Ω to 0.600 Ω (3.0 A to 42.0 A)
- LC 1 μA to 100 mA(rms)

Rise Time Fall Time LAN USB RS232C Timer

- D 430(16.93")(440(17.32"))W×132(5.2")(155(6.10"))H ×500(19.69")(550(21.65"))Dmm
- W 22 kg(48.5 lbs)

TOS9303 P.95
AC/DC Hipot Tester with Insulation Resistance and Ground Bond Test

- ACW 5 kV/100 mA(500 VA)
- DCW 5 kV/20 mA,7.2 kV/13.9 mA(100 W)
- IR 0.001 MΩ to 100.0 GΩ (DC-25 V to -1000 V/DC+50 V to +7200 V)
- EC 0.001 Ω to 0.600 Ω (3.0 A to 42.0 A)

Rise Time Fall Time LAN USB RS232C Timer

- D 430(16.93")(440(17.32"))W×132(5.2")(155(6.10"))H ×500(19.69")(540(21.26"))Dmm
- W 21 kg(46.3 lbs)

TOS9302 P.95
AC Hipot Tester with Ground Bond Test

- ACW 5 kV/100 mA(500 VA)
- EC 0.001 Ω to 0.600Ω (3.0 A to 42.0 A)

Rise Time Fall Time LAN USB RS232C Timer

- D 430(16.93")(440(17.32"))W×132(5.2")(155(6.10"))H ×500(19.69")(540(21.26"))Dmm
- W 20 kg(44.1 lbs)

Hipot Tester with Insulation Resistance Test
High-End
High-performance type suitable for R&D, quality assurance, and automatic testing systems

TOS9213AS P.97
- DCW 10 kV/5 mA
- IR 0.01 MΩ to 9.99 GΩ (DC-25 V to -1500 V)

Rise Time GPIB RS232C Timer

- D 430(16.93˝)W×132(5.2˝)H×400(15.75˝)Dmm
- W 13 kg(41.89 lbs)

- ACW Max. output-voltage of AC hipot testing
- DCW Max. output-voltage of DC hipot testing
- IR Measurement range of insulation resistance testing
- EC Measurement range of ground bond testing
- LC Measurement range of leakage current testing
- PD Measurement range of partial discharge testing
- D Dimensions
- W Weight

- Rise Time Equipped with rise time control function
- Fall Time Equipped with fall time control function
- LAN Equipped with LAN interface as standard
- GPIB Equipped with GPIB interface as standard
- RS232C Equipped with RS232C interface as standard
- USB Equipped with USB interface as standard
- Timer Equipped with timer function

Hipot Tester
Standard
Standard type suitable for production and inspection lines

TOS5302 P.98
- ACW 5 kV/100 mA(500 VA)
- IR 0.03 MΩ to 5 GΩ (DC-25 V to -1000 V)

Rise Time Fall Time USB Timer

- D 320(12.60˝)W×132(5.2˝)H×350(13.78˝)Dmm
- W 14 kg(30.9 lbs)

TOS5301 P.98
- ACW 5 kV/100 mA(500 VA)
- DCW 6 kV/10 mA(50 W)

Rise Time Fall Time USB Timer

- D 320(12.60˝)W×132(5.2˝)H×350(13.78˝)Dmm
- W 15 kg(33.1 lbs)

TOS5300 P.98
- ACW 5 kV/100 mA(500 VA)

Rise Time Fall Time USB Timer

**"Fall Time" can be set at 0.1 s or OFF

- D 320(12.60˝)W×132(5.2˝)H×350(13.78˝)Dmm
- W 14 kg(30.9 lbs)

TOS5200 P.100
- ACW 5 kV/100 mA(500 VA)

Rise Time Fall Time USB RS232C Timer

**"Fall Time" can be set at 0.1 s or OFF

- D 320(12.60˝)W×132(5.2˝)H×350(13.78˝)Dmm
- W 14 kg(30.9 lbs)

TOS5101 P.100
- ACW 10 kV/50 mA(500 VA)
- DCW 10 kV/5 mA

Timer

- D 430(16.93˝)W×177(6.97˝)H×370(14.57˝)Dmm
- W 21 kg(46.3 lbs)

Costsaving
Low-cost type

TOS8030 P.100
- ACW 3 kV/10 mA(30 VA) For simplified test

Timer

- D 160(6.3˝)W×132(5.2˝)H×230(9.06˝)Dmm
- W 6 kg(13.23 lbs)

Partial discharge testing, this analyzer covers it all!

Under development

TOS9301PD P.94

AC/DC Hipot Tester with Insulation Resistance and Partial Discharge Test

ACW 5 kV/100 mA(500 VA)
DCW 5 kV/20 mA,7.2 kV/13.9 mA(100 W)
IR 0.001 MΩ to 100.0 GΩ (DC-25 V to -1000 V/ DC+50 V to +7200 V)
PD

Rise Time Fall Time LAN USB RS232C Timer

D 430(16.93")(440(17.32"))W×132(5.2")(155(6.10"))H ×500(19.69")(540(21.26"))Dmm
W 24 kg(52.9 lbs)

TOS9301 P.94

AC/DC Hipot Tester with Insulation Resistance Test

ACW 5 kV/100 mA(500 VA)
DCW 5 kV/20 mA,7.2 kV/13.9 mA(100 W)
IR 0.001 MΩ to 100.0 GΩ (DC-25 V to -1000 V/ DC+50 V to +7200 V)

Rise Time Fall Time LAN USB RS232C Timer

D 430(16.93")(440(17.32"))W×132(5.2")(155(6.10"))H ×370(14.57")(410(16.14"))Dmm
W 18 kg(39.7 lbs)

TOS9300 P.94

AC Hipot Tester with Insulation Resistance Test

ACW 5 kV/100 mA(500 VA)
IR 0.001 MΩ to 100.0 GΩ (DC-25 V to -1000 V)

Rise Time Fall Time LAN USB RS232C Timer

D 430(16.93")(440(17.32"))W×132(5.2")(155(6.10"))H ×370(14.57")(410(16.14"))Dmm
W 17 kg(37.5 lbs)

TOS9320 P.96

High-voltage Scanner

High voltage scanner for TOS9300 series multi-channel testing systems

D 430(16.93")(440(17.32"))W×88(3.46")(105(4.13"))H ×370(14.57")(390(15.35"))Dmm
W 8 kg(17.6 lbs)

Insulation Resistance Tester

TOS7200 P.102

IR 0.01 MΩ to 5000 MΩ (DC-25 V to -1000 V)

RS232C Timer

D 215(8.47˝)W×66(2.6˝)H×230(9.06˝)Dmm
W 2 kg(4.41 lbs)

PID Insulation Tester

TOS7210S P.102

IR 0.01 MΩ to 5000 MΩ (DC50 V to 2000 V)
0.000 μA to 1900 μA(DC50 V to 2000 V)

RS232C Timer

D 214(8.43)W×81(3.19˝)H×340(13.39˝)Dmm
W 2 kg(4.41 lbs)

Ground Bond Tester

TOS6210 P.101

EC 0.001 Ω to 0.600 Ω (6 A to 62 A)

GPIB RS232C Timer

D 430(16.93˝)W×88(3.47˝)H×270(10.63˝)Dmm
W 11 kg(24.25 lbs)

TOS6200A P.101

EC 0.001 Ω to 1.200 Ω (3 A to 30 A)

GPIB RS232C Timer

D 430(16.93˝)W×88(3.47˝)H×270(10.63˝)Dmm
W 9 kg(19.84 lbs)

Leakage Current Tester

TOS3200 P.103

LC 30 μA to 30 mA(rms)

USB GPIB RS232C Timer

D 320(12.6˝)W×88(3.47˝)H×270(10.63˝)Dmm
W 5 kg(11.02 lbs)

Options

- Remote Control Box
- Test Probe
- Test Lead
- Warning Light Unit
- Buzzer Unit
- Calibrator for a W. Tester
- High-voltage Digital Voltmeter
- Load resistor for calibration of a Hipot Tester

P.104 to 105

The Electrical Appliance & Material Safety Low (Japan), UL (U.S.A.), CSA (Canada), VDE (Germany) and BS (U.K) are some major examples of safety standards in use throughout the world that require the performing of hipot testing. For this reason, it is necessary to confirm for what portion of what standard testing is to be performed when purchasing a hipot tester. Although the 500 VA capacity hipot testers available from KIKUSUI can basically be applied to tests specified in all safety standards, we recommend that you consult with us prior to purchase in order to select the model that best matches your specific application.

For the withstanding test and the insulation resistance test of the EUT (Equipment Under Test) with turned on electricity.

Our Hipot Testers and Insulation Resistance Testers are designed to test the EUT (Equipment Under Test) with its electricity swithed off. In case the test requires the EUT (Equipment Under Test) with the electricity turned on, please contact with our distributor or agent.

Hipot Tester with Insulation Resistance Test

TOS9300/9301

LAN USB RS232C CE LXI

*Refer to page 8

TOS9300(AC)

TOS9301(AC/DC)

High-performance hipot tester with insulation resistance capabilities

The TOS9300/9301 is a high performance electrical safety analyzer with hipot tester and insulation resistance capabilities for international safety standards. Wide-ranging hipot capabilities and insulation resistance capabilities make the TOS9300/9301 the perfect safety analyzer for R&D equipment, quality assurance testing, standard compliance tests and product line equipment. Combined with the high voltage scanner TOS9320, the TOS9300 series can be automated into a safe, reliable test system with up to 16 channels.

Dimensions / Weight

TOS9300: 430(16.93″)W X 132(5.2″)H X 370(14.57″)Dmm(inch) / 17 kg(37.5 lbs)
TOS9301: 430(16.93″)W X 132(5.2″)H X 370(14.57″)Dmm(inch) / 18 kg(39.7 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information
TOS9301 only: Heavy object warning label(Affix this to the product as necessary.)

Features

- AC5 kV/100 mA, DC7.2 kV/100 W Hipot test
- Electrical breakdown inspection setting available
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

Hipot Tester with Insulation Resistance and Partial Discharge Test

TOS9301PD

LAN USB RS232C LXI

Under develop-ment

AC/DC Hipot tester with insulation resistance and partial discharge test capabilities

The TOS9301PD is an electrical safety analyzer capable of AC and DC hipot, insulation resistance, and partial discharge testing. Wide-ranging hipot capabilities, insulation resistance and partial discharge testing features make the TOS9301PD the perfect safety analyzer for R&D equipment, quality assurance testing, standard compliance tests and product line equipment. Combined with the high voltage scanner TOS9320, the TOS9301PD can be automated into a safe, reliable test system with up to 16 channels.

Dimensions / Weight

430(16.93″)W X 132(5.2″)H X 500(19.69″)Dmm(inch) / 24 kg(52.9 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information, Heavy object warning label(Affix this to the product as necessary.)

Features

- AC5 kV/100 mA, DC7.2 kV/100 W Hipot test
- Insulation diagnosis available with partial discharge model
- Electrical breakdown inspection setting available
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

Hipot Tester with Ground Bond Test

TOS9302

LAN USB RS232C CE LXI

*Refer to page 8

AC Hipot tester with ground bond test capabilities

The TOS9302 is an electrical safety analyzer capable of AC hipot tester and ground bond test capabilities. Accurate AC hipot and ground bond testing features make the TOS9302 the perfect safety analyzer for R&D equipment, quality assurance testing, standard compliance tests and product line equipment. Combined with the high voltage scanner TOS9320, the TOS9302 can be automated into a safe, reliable test system with up to 16 channels.

Dimensions / Weight

430(16.93″)W × 132(5.2″)H × 500(19.69″)Dmm(inch) / 20 kg(44.1 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information, Heavy object warning label(Affix this to the product as necessary.), Test leads for earth continuity test [TL13-TOS]

Features

- AC5 kV/100 mA Hipot test
- New amplifier type allows for 40 A AC/DC ground bond testing
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

Hipot Tester with Insulation Resistance and Ground Bond Test

TOS9303

LAN USB RS232C CE LXI

*Refer to page 8

AC/DC Hipot tester with insulation resistance and ground bond test capabilities

The TOS9303 is a highly versatile electrical safety analyzer capable of AC/DC hipot, insulation resistance, and ground bond testing. Combined with the high voltage scanner TOS9320, the TOS9303 can be automated into a safe, reliable test system with up to 16 channels.

Dimensions / Weight

430(16.93″)W × 132(5.2″)H × 500(19.69″)Dmm(inch) / 21 kg(46.3 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information, Heavy object warning label(Affix this to the product as necessary.), Test leads for earth continuity test [TL13-TOS]

Features

- AC5 kV/100 mA, DC7.2 kV/100 W Hipot test
- New amplifier type allows for 40 A AC/DC ground bond testing
- Electrical breakdown inspection setting available
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

Hipot Tester with Insulation Resistance, Ground Bond, and Leakage Current Test

TOS9303LC

LAN USB RS232C LXI CE

*Refer to page 8

The all-in-one multi analyzer capable of AC/DC hipot tester, insulation resistance, ground bond, and leakage current testing

The TOS9303LC is the "all-rounder" electrical safety analyzer capable of conducting AC/DC hipot, insulation resistance, ground bond and leakage current testing in a single model. Combined with the high voltage scanner TOS9320, the TOS9303LC can be automated into a safe, reliable test system with up to 16 channels.

Dimensions / Weight

430(16.93″)W × 132(5.2″)H × 500(19.69″)Dmm(inch) / 22 kg(48.5 lbs)

Accessories

Power cord(2 pcs), High-voltage test lead [TL31-TOS], High-voltage warning sticker, Cable tie, SIGNAL I/O plug(Assembly type D-sub plug unit), Setup guide, CD-ROM, Safety Information, Heavy object warning label(Affix this to the product as necessary.), Test leads for earth continuity test [TL13-TOS], Spare fuse(15 A, 250 V *Stored in the fuse holder), Test leads for leakage current test [TL22-TOS], Flat probe [FP01-TOS]

Features

- AC5 kV/100 mA, DC7.2 kV/100 W Hipot test
- New amplifier type allows for 40 A AC/DC ground bond testing
- Touch current/protective conductor current/leakage current testing
- Electrical breakdown inspection setting available
- LAN/USB/RS232C standard digital interface
- Easy to read LCD display for real time monitoring during tests, All measurement values and standard outlines displayed in each test

High-voltage Scanner

TOS9320

CE

*Refer to page 8

High voltage scanner for TOS9300 series multi-channel testing systems

The TOS9320 high voltage scanner allows for rapid distribution of testing voltage from the main unit to multiple testing points for withstanding voltange and insulation resistance testing. Channels can be controlled via an external device through the rear panel CONTROLLER INTERFACE connector. The scanner can also be used standalone or with an external control device for other Kikusui withstanding voltage and insulation resistance testing instruments. Hipot tests for electronic devices with multiple testing points have never been easier.

Dimensions / Weight

430(16.93″)W × 132(5.2″)H × 500(19.69″)Dmm(inch) / 8 kg(17.6 lbs)

Accessories

Power cord, High-voltage test lead [TL31-TOS], Lead for high voltage parallelconnection [TL33-TOS], Interface cable, CONTROLLER INTERFACE plug (Assembly type)[D-sub plug unit], High-voltage warningsticker(2 pc.), Channel labels(For the panel , For the test leads), User's manual, Safety Information

Features

- Output can be expanded to four channels with one high-voltage scanner. The electric potential of each channel can be arbitrarily set to high, low, or open, and can be tested at any of these four points.
- Up to four high voltage scanners (total 16 channels) can be connected to each unit.
- Output of each channel and contact with testing points can be easily monitored.
- High voltage scanner capable of output distribution both standalone and when connected with existing withstanding voltage/insulation resistance testing equipment models [TOS5300 series, etc.]

Hipot Tester with Insulation Resistance Test * While Supplies Last

TOS9213AS

GPIB RS232C

Dimensions / Weight

430(16.93″)W × 132(5.2″)H × 370(14.57″)Dmm(inch) / 13kg(28.7 lbs)

Accessories

AC Power cable, High-voltage test lead wire [TL01-TOS](1.5 m), 14-pin Amphenol plug(assembly type), “DANGER HIGH VOLTAGE” sticker, AC power fuse (One in present use and the other as spare in the fuse holder cap), Operation manual

Suitable for insulation testing of PV modules

TOS9213AS is a test instrument that can handle high-voltage and high-sensitivity insulation tests required for the evaluation of PV modules, cables, connectors, and junction boxes. High system voltages are required as mega-solar systems become more widespread. Durability is also required for the cables and connectors that are used. With the DC withstanding voltage and insulation resistance test functions, insulation resistance measurements have been increased from an applied voltage value of -1000 V to -1500 V. Therefore, insulation tests and wet leakage current tests are possible for PV modules with a system voltage up to 1500 V based on IEC61215 and 61646. This updated model features the functions and performance of the high-end models in Kikusui’s TOS9200 series, while also meeting the needs of the PV market. An insulation resistance test voltage of up to -1500 V can be used even as the high-voltage power supply applied to PID (Potential Induced Degradation), a phenomenon currently viewed as important in the PV market.

Features

- 10kV/5mA, and a maximum output of 50W for DC withstanding voltage test
- Insulation resistance tests in the range of DC -25 V to -1500 V / 0.01 MΩ to 9.99 GΩ
- Compatible with IEC61215, IEC61646, IEC61730-2, JIS C 8990, JIS C 8991, JIS C 8992-1&2, UL1703
- Covers all test voltages in JIS C 1302 2002 (insulation resistance testers)
- Display and make determinations based on leakage current values, in addition to resistance value determinations during insulation resistance testing
- Supports voltage recovery after testing is complete, with a forced discharge timer function of up to 300 seconds
- Continuous power during insulation resistance testing for PID: current capacity of -25 V to -1020 V / 1 mA and -1021 V to -1500 V / 0.1 mA

Hipot Tester / Hipot Tester with Insulation Resistance Test

TOS5300 Series

USB DRIVERS CE

*Refer to page 8

TOS5301

TOS5300

TOS5302

A new standard for Hipot & Insulation resistance testing Applied to World-Wide input voltage

The TOS5300 Series are test instruments used in Hipot tests and insulation resistance tests, two of the four tests regarded as necessary for ensuring the safety of electrical products. With an output of 5 kV/100 mA (AC) and 6 kV/50 W (DC), the series can be used in Hipot & insulation resistance testing of electronic equipment and electronic parts, based on the requirements of IEC, EN, UL, VDE, JIS, and other international safety standards and the Electrical Appliance and Material Safety Law. Also, the test voltage stability is improved with the adoption of a newly developed switching amplifier. Since the output voltage can be kept constant even when the AC line voltage or frequency changes, consistent testing can be performed, even when the power supply environment is in an unstable region. The TOS5300 is also equipped with a number of features that are capable of meeting a variety of test needs. It is a new low-cost standard model that provides thorough operability, reliability and safety.

Dimensions / Weight

TOS5302: 320(12.60″)W × 132(5.20″)H × 350(13.78″)Dmm(inch) / 14kg(30.9 lbs)
TOS5301: 320(12.60″)W × 132(5.20″)H × 350(13.78″)Dmm(inch) / 15kg(33.1 lbs)
TOS5300: 320(12.60″)W × 132(5.20″)H × 350(13.78″)Dmm(inch) / 14kg(30.9 lbs)

Accessories

Power cord, High-voltage test lead wire [TL31-TOS], High-voltage warning sticker, D-sub 25-pin plug, User's Manual, CD-R(Contains the Communication Interface Manual, the KI-VISA library, and the Safety evalution test.)

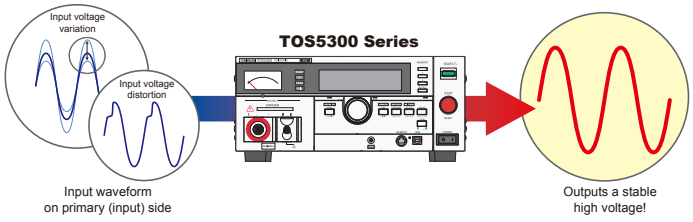
Features

TOS5302: ■Hipot (Withstanding voltage): AC 5 kV/100 mA
Insulation Resistance: 25 V - 1000 V
TOS5301: ■Hipot (Withstanding voltage): AC 5 kV/100 mA, DC 6 kV/50 W
TOS5300: ■Hipot (Withstanding voltage): AC 5 kV/100 mA
Common: ■The PWM amp system provides highly-stable output
■High-precision measurement ± 1.5 % of reading
■Rise/Fall time control function
■Key lock function and Protection cover on the panel operation
■Limit voltage function
■Monitoring output voltage function
■Calibration due notice and warning function
■Equipped with USB interface

Features and Functions

■ The PWM amplifier provides highly stable output! [Input voltage variation: ± 0.3 %]

The TOS5300 Series equips with a high-efficient PWM amplifier that can output a stable high-voltage without being affected by the variation of AC power line, users can perform "safe", "stable", and highly "reliable" tests with confidence, even in regions with large voltage variations.



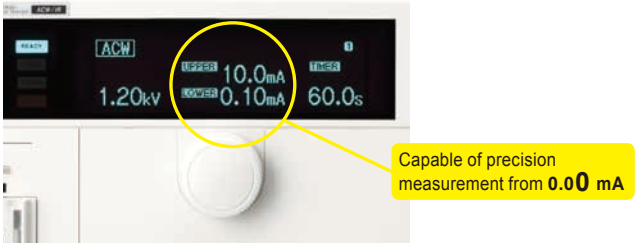
■ 6 kV/50 WDC Hipot (Withstanding voltage) test [Model TOS5301]

Capable to perform DC Hipot (Withstanding voltage) test up to 6 kV. (Model TOS5301) Equipped with a stable DC/DC converter with a low-ripple and the load variation of 3 % or less.

■ Realizing high-precision measurement with high-resolution and high-speed judgement

Equipped with a high-accuracy, high-resolution of True RMS measurement circuit, including a Voltmeter with ± 1.5 % of reading (500 V or greater)/ minimum resolution of 1V, and an Ammeter with ± 1.5 % of reading (1 mA or more)/minimum resolution of 1 µA.

In addition, it is also equipped with an Auto range function, with achieving a judgment accuracy of ± 1.5 % of reading. The Lower limit judgment accuracy achieves a level of performance equivalent to the Upper limit judgment accuracy that enables to detect for such a poor contact or disconnections of test leads. Moreover, it realizes the fast judgment by the test time of 0.1 second, while reliable testing can be performed, thanks to high-precision, high-resolution, high-speed measurement and the judgment functions.



▲ AC Hipot (Withstanding voltage) test settings display (example)

Features and Functions

■ Insulation resistance test for 25 V to 1000 V* [Model TOS5302]

The TOS5302 is equipped with an insulation resistance tester. The test voltages can be set from 25 V, 50 V, 100 V, 125 V, 250 V, 500 V and 1000 V. And for setting at 500 V and above, it can perform the insulation resistance test up to 5.00 GΩ.

*At 500 V and above, measurements up to 5.00 GΩ are possible.

■ Protection cover prevents physical operation error in the production site

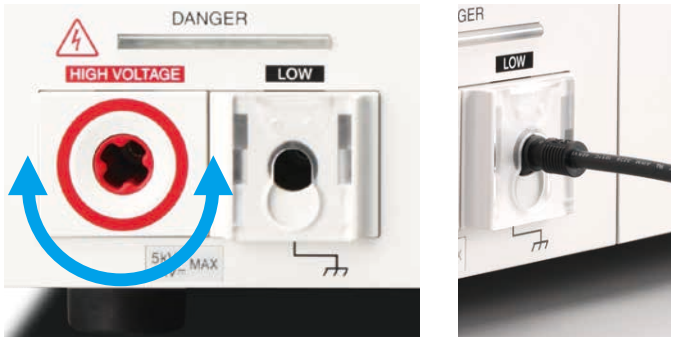
In many cases, workers on electronic equipment production lines and inspection lines are not technical experts. Therefore, it is possible that the operators may change setting conditions and make operation errors. In order to prevent from such cases, the TOS5300 is equipped with a key lock function and a protection cover to disable a physical key operation from the front panel.

▲ View with the protection cover removed

▲ Storing the protection cover for the key operation to the base of unit.

■ New design of output terminal improves safety and functionality

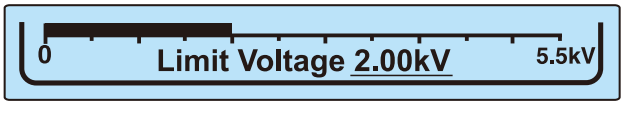
The free rotation machanisim protects from twisting (or breaking) of the cable. Also, with having the lock function for the LOW terminal on the main unit, the metal plate is no longer attached to the test lead of LOW-side, and it makes to resist damage to the test lead. Because of elimination of these projected components, the TOS5300 can avoid from unexpected accidents such as when the unit travels to other location. And also when the test lead is snagged on something, or unexpected stress is applied on the test lead, the High (High-voltage) test lead is designed to disconnect easily, but the Low (ground) test lead is designed to resist disconnection.



▲ Flat surface design of the HIGH terminal with free rotation mechanism, and the LOW terminal with lock function

■ Limit voltage function

Prevents the user from setting a test voltage that exceeds the preset voltage.



▲ LIMIT VOLTAGE setting (example)

■ Monitoring output voltage function

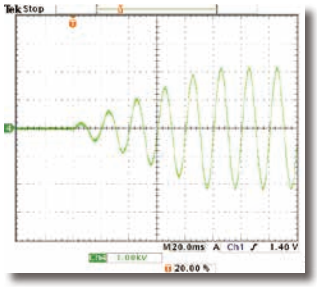
If the output voltage exceeds the setting voltage of (± 350 V), it turns off the output and the system switches to PROTECTION mode.

In order to handle kilo's of high voltage when the Hipot (Withstand voltage) and insulation tests are conducted, there are number of safety measures are required to take place. Having with these functions improve, the operational safety and the protection for the EUT.

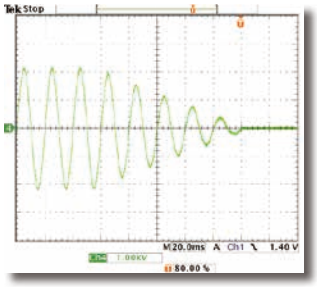
■ Rise/Fall time control function

The Rise time control function enables you to increases the test voltage gradually to reach the setting voltage while the AC Hipot (Withstanding voltage) test is conducted. The voltage rise time can be set from 0.1 s to 10.0 s at a resolution of 0.1 s.

The Fall time control function enables you to decrease the test voltage gradually when the PASS judgment is made at the AC Hipot (Withstanding voltage) test. The voltage fall time is fixed at 0.1 s. (OFF is also selectable).



▲ Rise time control waveform (example)



▲ Fall time control waveform (example)

■ Interlock feature

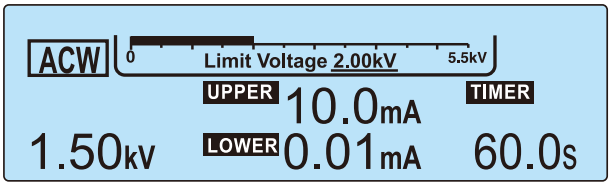
The product is equipped with an interlock function that operates together with external devices to interrupt output. To ensure the safe operation of tester, the interlock function activates when the SIGNAL I/O connector pins number 1 and 13 are opened, and when they are short-circuited, the interlock function is released.

■ Discharge feature [Model TOS5301/TOS5302]

Equipped with a forced discharge function that forcibly discharge the electricity which has been charged in the EUT after the completion of DC Hipot (Withstanding voltage) test or insulation resistance test.

■ Upper limits/Lower limits setting function

It automatically detects connector lead breaks and disconnections of wiring by measuring extremely small amounts of current that flows when voltage is applied to the EUT.



▲ Example setting display of Upper limit, Lower limit, and Test time

■ Calibration due notice and Warning function

To assure the traceability of periodic calibration of the product, this function gives a notice of calibration due managed by the builtin real-time clock. Even if the due data has elapsed, it is possible to avoid the oversight of operator with limiting the operation with a display of warning message.

■ AUTO TEST feature for consecutive testing [Model TOS5302]

The TOS5302 can perform an AC Hipot (Withstanding voltage) test and an insulation resistance test consecutively.

Either of the following can be conducted :

Insulation resistance test → AC Hipot (Withstanding voltage) test, or

AC Hipot (Withstanding voltage) test → Insulation resistance test.

Hipot Tester

TOS5200

USB RS232C CE

*Refer to page 8

Dimensions / Weight

320(12.60″)W × 132(5.20″)H × 350(13.78″)Dmm / 14kg(30.9 lbs)

Accessories

Power cord, High-voltage test lead wire [TL31-TOS], High-voltage warning sticker, D-sub 25-pin plug, Setup Guide, Quick Reference, Safety information, CD-R(Contains the Communication Interface Manual, the KI-VISA library, and the Safety evalution test.)

A Perfect AC Hipot Test solution, with 500 VA capacity and equipped PWM amplifier at very affordable investment

TOS5200 is designated model for AC Hipot Test with 500 VA capacity and 200 mA short circuit current output capability. With equipped PWM amplifier, this model can provide a stable & reliable output without being affected by AC power line. Therefore, it is a perfect AC Hipot Test solution for electronic equipment or devices based upon IEC, EN, UL, VDE and JIS etc. requirement. As TOS5200 maintains most of all features of our upper class model for AC Hipot Test, it achieves the superb cost / performance ratio for those who needs 200 VA or 500 VA capacity, or both. Also, as it equips Interlock function together with other safety features, operator can carry out the Test with higher current value in safe.

Features

- Hipot (Withstanding voltage): AC 5 kV/100 mA
- High-precision measurement ± 1.5 % of reading
- Rise/Fall time control function
- Key lock function and Protection cover on the panel operation
- Limit voltage function
- Monitoring output voltage function
- Equipped with USB and RS232C interface as standard

Hipot Tester (AC/DC)

TOS5101

Dimensions / Weight

430(16.93″)W × 177(6.97″)H × 370(14.57″)Dmm(inch) / 21 kg(46.3 lbs)
(for line voltage of 100 V)

Accessories

High-voltage test lead wire [TL01-TOS] (max.allowablevoltage: 5 kV/1.5 m), [TL03-TOS] (max.allowablevoltage: 10 kV/1.5 m)

Exclusive model of TOS Series having AC, DC10 kV output

The TOS5101 is exclusively designed for the Hipot testing of electronic equipment and components conforming to various safety standards.

*In general, when the capacitance of DUT has a voltage dependence (such as a "High-dielectric constant ceramic capacitor"), please take a caution that the waveform distortion may occurs.

Features

- Complies with various safety standards
- AC/DC output (0 kV to 10 kV)
- Large color display
- Digital voltmeter and ammeter
- Digital timer
- Window comparator type employed for PASS/FAIL judgement.
- Equipped with remote control function
- Various signal outputs
- Automatic discharge function (during DC operation)
- Provided with zero turn-on switch
- Compact size

Hipot Tester (AC)

* While Supplies Last

TOS8030

Dimensions / Weight

160(6.3″)W × 132(5.2″)H × 230(9.06″)Dmm(inch) / 6 kg(13.23 lbs)

Accessories

High-voltage test lead wire [TL01-TOS] (1.5 m), Power cord, INTERLOCK jumper, Operation Manual

Compact model supporting the simplified test

The TOS8030 is a withstanding voltage tester with a maximum output of 3 kV/10 mA. Though this unit is compact and light, it is capable to judge in the range of 0.1 mA to 10 mA with the resolution of 0.1 mA, and it also equips with the timer function, signal output and the remote terminal.

*Please note that the TOS8030 withstanding voltage tester is designed for the simple test and which specifications will not meet some of the safety standard requirements.

Features

- Compact and lightweight (approx. 6 kg)
- Withstanding voltage: 3 kVac/10 mA
- Judgment range: 0.1 mA to 10 mA
- Digital timer (0.5 to 9.9 s; 1 to 99 s, Resolution: 0.1 s)
- Zero turn-on switch

Ground Bond Tester

TOS6210

GPIB RS232C DRIVERS CE

*Refer to page 8

Dimensions / Weight

430(16.93″)W × 88(3.47″)H × 270(10.63″)Dmm(inch) / 11kg(24.25 lbs)

Accessories

AC power cord, Test lead wire [TL12-TOS], Short bar(2 pcs., these are inserted between the OUTPUT and SAMPLING terminals.), AC power fuse(2 pcs., including one spare in the fuse holder), Operation manual

Supports UL60950-1(40 A / 60 A) testing - New Standard for Information Technology Equipment (ITE)

The TOS6210 tester extends the maximum test current from 30 A to 60 A, which is demanded by the new standard. In addition, the tester also lets you judge the acceptability of the device under test based on the drop in voltage, as required in the standard. What's more, you can preset test conditions of up to 20 different types of safety standards, such as those for information technology equipment, home appliances, medical devices, and measuring instruments, in the memory on the main unit's panel. A simple memory call operation allows you to set up a protective earthling or protective bonding continuity test as stipulated in UL60950-1 and other relevant specifications including IEC and JIS standards. The tester also features a set of functions that meet the specific needs of testing personnel, such as an offset cancellation function and a memo function that allows you to input calibration dates, production numbers, and other test-related information and read the input information later via the GPIB or RS232C interface.

Features

- Test current value: 6 A to 62 A AC/Resistance value: 0.001 Ω to 0.600 Ω
- Voltage judgement function
- Offset cancelling function
- Stores 100 test conditions in memory
- Incorporates test conditions into program
- Contact Check function
- Equipped with standard GPIB and RS232C interfaces
- Equipped with standard test lead (TL12-TOS)

Ground Bond Tester

TOS6200A

GPIB RS232C DRIVERS CE

*Refer to page 8

Dimensions / Weight

430(16.93″)W × 88(3.47″)H × 270(10.63″)Dmm(inch) / 9kg(19.84 lbs)

Accessories

AC power cord, Test lead wire [TL11-TOS], Short bar(2 pcs., these are inserted between the OUTPUT and SAMPLING terminals.), AC power fuse(2 pcs., including one spare in the fuse holder), Operation manual

Suitable design for the automated ground bond testing adopted with the constant current method.

The TOS6200A is designed to perform the ground bond tests required for class-I devices by safety standards such as IEC, EN, VDE, BS, UL, JIS, and the Electrical Appliance and Material Safety Low (Japan). Equipped with a new high-efficiency power supply, it is compact and lightweight, about half the size and weight of our conventional products, while achieving a large output of 150 VA. Use of the constant current method eliminates the need to reset test currents even in the face of fluctuating resistance values for the device being tested. The test duration can also be set from 0.3 s, making the tester suitable for production line testing, which requires reduced cycle time. This tester is also designed for ease of use, featuring a large, easy-to-read display, memory capacity for storage of 100 types of test conditions, and incorporation of test conditions into programs to enable automatic testing. The standard equipped GPIB and RS232C interfaces allow the user to use PCs or other devices to control test conditions such as test current, resistance value for judgement, and test duration, and enables read-back of measured values and test results.

Features

- Test current value: 3 A to 30 A AC/Resistance value: 0.001 Ω to 1.200 Ω
- Offset cancelling function
- Stores 100 test conditions in memory
- Incorporates test conditions into program
- Contact Check function
- Equipped with standard GPIB and RS232C interfaces
- Equipped with standard test lead (TL11-TOS)
- Capable to judge by the resistance value and the voltage drop

Insulation Resistance Tester

TOS7200

RS232C

Dimensions / Weight

215(8.47″)W × 66(2.6″)H × 230(9.06″)Dmm(inch) / 2kg(4.41 lbs)

Accessories

AC power cable, High-voltage test lead wires [TL08-TOS] (1.5 m), Operation Manual

Complied with the test voltage -25 VDC to -1000 VDC of the JIS C 1302-2002

The TOS7200 is an insulation resistance tester available for a wide range of various electric and electronic components, as well as electric and electronic equipment. The output voltage can be set at desired value in the range of -25 VDC to -1,000 VDC with a resolution of 1 V. (conforms with the output characteristics of the JIS C 1302-2002). As it is fitted with a window comparator and timer function, the tester is capable of efficiently conducting insulation resistance tests based on various safety standards. In addition, this product is equipped with panel memory as standard feature, which can be recalled by remote control, SIGNAL I/O connector, and the RS232C interface for easy automatic testing system construction.

Features

- Output voltage range: -25 VDC to -1000 VDC (conforms with the output characteristics of the JIS C 1302-2002)
- Resistance measurement range: 0.01 MΩ to 5000 MΩ
- Provided with the discharge function
- Equipped with the window comparator
- Hold function (which holds the measured resistance at the end of testing while PASS judgment is being output)
- Provided with the timer function
- Rear output terminals
- Measured-value monitoring terminals
- Equipped with the panel memory (enabling 10 different settings to be stored)
- Equipped with the SIGNAL I/O connector and remote control terminal
- Equipped with RS232C interface as standard

PID Insulation Tester

TOS7210S

RS232C

Dimensions / Weight

214(8.43″)W × 81(3.19″)H × 340(13.39″)Dmm(inch) / 2kg(4.41 lbs)

Capable of continuous long-term operation for applying the high voltage required to the PID affect of the PV module

Lately, the PID (Potential Induced Degradation) evaluation has become important issue since the PV generation system requires higher voltage and adopting the transless-type inverter for high efficiency. The TOS7210S, Insulation Resistance Tester for the PID testing, is designed to operate continuous long-term testing required for applying high-voltage (±2000 V) required to the PID evaluation. (accelerating of the PID affect)

Features

- Applied voltage: ± 2000 V
- Switchable Polarity of the test voltage
- Capable of measuring the insulation resistance and the current
- Capable of continuous long-term operation for applying the high voltage required to the PID affect of the PV module

Leakage Current Tester

TOS3200

USB GPIB RS232C

Features

- Measures leakage current in 3 operation modes: Touch Current (TC), Protective Conductor Current (PCC), and METER operation mode
- Eight types of measuring circuit networks are incorporated in the tester for measuring the touch current of general electrical apparatuses
- Possible to measure DC/RMS/PEAK, realizing the "true root-mean-square value" with 30 mA as the maximum RMS
- User-friendly operability
- Possible to choose between Independent and Automatic Testing
- 51 types of preset safety standard tests
- Function for controlling the calibration expiration limits

Complying with various safety standards for general electrical equipment, this tester is used for touch current and protective conductor current tests!!

The TOS3200 is designed to test for leakage current (Touch Current and Protective Conductor Current) of general electrical apparatuses, excluding those used for medical purposes. With this tester, you can conduct tests conforming to various standards including IEC, UL, JIS and Electrical Appliance and Material Safety Law (Japan). You can set test conditions through simple operations on the panel because this tester holds in its memory the 51 types of test conditions for IT-related electrical equipment, electrical appliances, audio & visual equipment, lighting fixtures, power tools, and measuring and control instruments, accordingly with the standards of IEC/JIS and Electrical Appliance and Material Safety Law.

Dimensions / Weight

320(12.6″)W × 88(3.47″)H × 270(10.63″)Dmm(inch) / 5kg(11.02 lbs)

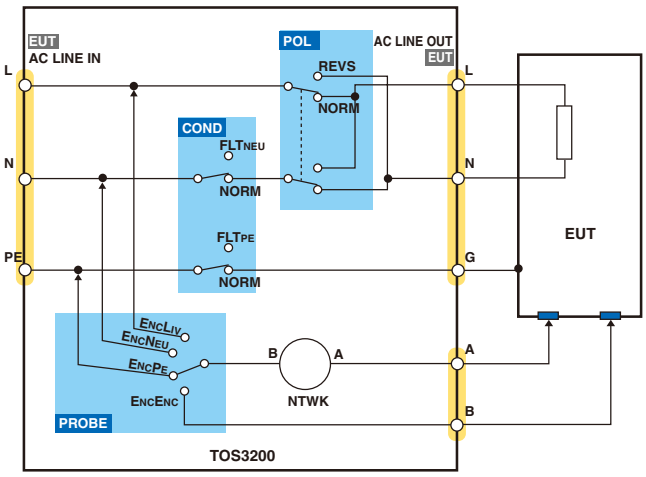
Accessories

AC power cord (2 pcs.), Test lead wire [TL21-TOS] (1.5 m), Flat probe [FP01-TOS], Fuse (2 pcs.), Operation manual, Circuit principle drawing seal

● Three modes are available for leakage current measurements/Operation panel

TC (Touch Current) operation mode

In this mode, the tester measures the touch current running across enclosure surfaces (parts that can be touched) and the power line including the ground line of equipment under test (EUT) via a humanoid measuring instrument with circuit. Humanoid measuring instrument with circuit is equipped with eight types of measuring circuit networks (NTWK) as standard. The polarity change of the power line to the EUT and single fault condition are automatically set by the relays inside the tester.



[Conceptual diagram of the TC measurement]

PCC (Protective Conductor Current) operation mode

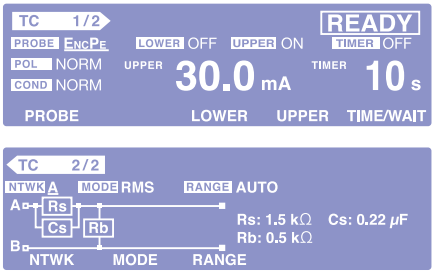
In this mode, the tester measures the current running on the protective conductor (ground line) of electrical equipment with its power supply plug (equivalent to NEMA5-15) connected to the power outlet on the front panel of the tester. A Multi-outlet Unit (option) is available for various types of electrical plugs used in different regions of the world.

METER operation mode

With its measuring probes A and B on the front panel, the tester measures the voltage or current of the EUT in the same way as a multi-meter. When measuring voltage, SELV (Safety Extra Low Voltage) detection function can be used while current is measured by utilizing the measuring circuit network (NTWK).

Excellent operability

The self-explanatory test condition menu screen, function keys, and rotary control knob successfully make tester operation very easy.



[Setting screen for TC measurement]

Options for Electrical Safety Testers

■ Test Lead

TL01-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV]

TL02-TOS
[cable length: 3 m/max. operating voltage: 5 kV]

TL03-TOS
[cable length: 1.5 m/max. operating voltage: 10 kV]

TL04-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV]

TL05-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV]

TL06-TOS
[cable length: 0.5 m/max. operating voltage: 5 kV]

TL07-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV]

TL08-TOS
[cable length: 1.5 m/max. operating voltage: 1 kV]

TL11-TOS
[cable length: 1.5 m/max. operating current: 30 A]

TL12-TOS
[cable length: 1.5 m/max. operating current: 60 A]

TL13-TOS
[cable length: 1.6 m/max. operating current: 40 A]

TL21-TOS
[cable length: 1.5 m]

TL22-TOS
[cable length: 1.7 m/max. rating: 1000 V, 10 A]

TL31-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV]

TL32-TOS
[cable length: 3 m/max. operating voltage: 5 kV]

TL33-TOS
[cable length: 0.5 m/max. operating voltage: 5 kV]

HTL-2.5DH
[cable length: 1.5 m/max. operating voltage: 10 kV]

■ Test Probe

HP01A-TOS *1 *2
[cable length: 1.8 m/max. operating voltage: 4 kV AC, 5 kV DC]
HP02A-TOS *1 *2
[cable length: 3.5 m/max. operating voltage: 4 kV AC, 5 kV DC]

HP11-TOS
[cable length: 1.8 m/max. operating voltage: 1 kV DC/max. operating current: 100 mA]

HP21-TOS
[cable length: 1.8 m/max.operating voltage: 250 Vrms/max.operating current: 100 mA]

FP01-TOS

LP01-TOS
[cable length: 2 m/max. operating current: 30 A].

LP02-TOS
[cable length: 2 m/max. operating current: 60 A]

■ Calibration Resistor for Insulation Resistance Tester *3

929-1M (1 MΩ)
929-10M (10 MΩ)
929-100M (100 MΩ)

*1: This can not be used with TOS7200.
*2: The optional adaptor DD-5P/9P is required for the connection with TOS5300, TOS5200 series and TOS9300 series.
*3: The 929 series standard resistors can not be installed directly to the TOS series. Please use the test lead for connection.

■ Remote Control Box

RC01-TOS *4 *5
[one-hand operation/dimensions: 200(7.87″)W × 70(2.76″)H × 39(1.54″)D mm(inch)/ cable length: 1.5 m]

RC02-TOS *4 *5
[both-hands operation/dimensions: 330(12.99″)W × 70(2.76″)H × 39(1.54″)D mm(inch)/ cable length: 1.5 m]

*4: The optional adaptor DD-5P/6P is required for the connection with TOS7200.
*5: The optional adaptor DD-5P/9P is required for the connection with TOS5300, TOS5200 serie and TOS9300 series.

■ DIN Cable

DD-3 5P
[Cable length: 3m/ DIN plug to DIN plug]

■ Adapter cable

DD-5P/6P
[Adaptor/DIN to Mini DIN]

■ Terminal Unit

TU01-TOS
TOS5300/TOS5200 series signal I/O converter unit (25 pin to 14 pin)

DD-5P/9P
[Adaptor/DIN to Mini DIN]

■ Warning Light Unit

PL01-TOS (for 100V AC)

PL02-TOS (for 24V DC)

■ Buzzer Unit

BZ01-TOS (for 100V AC)

■ Multi Outlet

OT01-TOS

Options for Electrical Safety Testers

■ Load resistor for calibration of a Hipot tester

RL01-TOS

The value of the resistor are selected to meet UL (UL1492, UL1409, UL1410) requirements

■ High-voltage digital voltmeter

149-10A
(AC/DC 10 kV)

For the details, please refer to 110 page.

EIA Standard Rack (Inch Size) Mounting Options

Product name	Bracket	
	Model name	Panel width *6
TOS9300/9301	KRB3-TOS	3
TOS9301PD	KRB3-TOS	3
TOS9302	KRB3-TOS	3
TOS9303	KRB3-TOS	3
TOS9303LC	KRB3-TOS	3
TOS9320	KRB2-TOS	2
TOS9213AS	KRB3-TOS	3
TOS5300/5301/5302	KRA4-TOS	4
TOS5200	KRA4-TOS	4
TOS6210	KRB2-TOS	2
TOS6200A	KRB2-TOS	2
TOS3200	KRA3-TOS	3

*6: EIA panel width is 44.45 mm (1 3/4 inch). The panel width does not include the rubber feet, casters, and levelers.

JIS Standard Rack (Millimeter Size) Mounting Options

Product name	Bracket	
	Model name	Panel width *7
TOS9300/9301	KRB150-TOS	3
TOS9301PD	KRB150-TOS	3
TOS9302	KRB150-TOS	3
TOS9303	KRB150-TOS	3
TOS9303LC	KRB150-TOS	3
TOS9320	KRB100-TOS	2
TOS9213AS	KRB150-TOS	3
TOS5300/5301/5302	KRA200-TOS	4
TOS5200	KRA200-TOS	4
TOS6210	KRB100-TOS	2
TOS6200A	KRB100-TOS	2
TOS3200	KRA150-TOS	3

*7: JIS panel width is 50 mm. The panel width does not include the rubber feet, casters, and levelers.

● Cross Reference of Options for Electrical Safety Testers

Model	Remote Control		Warning Light Unit, Buzzer Unit, Terminal Unit				Test Probe						Test Lead												
	RC01/02-TOS	DD-3 5P	PL01-TOS	PL02-TOS	BZ01-TOS	TU01-TOS	HP01A/02A-TOS	HP11-TOS	HP21-TOS	LP01-TOS	LP02-TOS	FP01-TOS	TL01/02/03-TOS	TL04-TOS	TL05-TOS	TL06-TOS	TL07-TOS	TL08-TOS	TL11/12-TOS	TL13-TOS	TL21-TOS	TL22-TOS	TL31/32-TOS	TL33-TOS	TL51-TOS	HTL2.5-DH
TOS9300	○			○			○																○	○		
TOS9301	○			○			○																○	○		
TOS9301PD	○			○			○																○	○		
TOS9302	○			○			○													○			○	○		
TOS9303	○			○			○													○			○	○		
TOS9303LC	○			○			○					○								○		○	○	○		
TOS9320																	○						○	○		
TOS9213AS	○	○		○			○						○	○		○										
TOS5101	○	○	○		○								○													
TOS5302	○			○		○	○																○			
TOS5301	○			○		○	○																○			
TOS5300	○			○		○	○																○			
TOS5200	○			○		○	○																○			
TOS6200A	○	○								○	○								○							
TOS6210	○	○								○	○								○							
TOS7200	○	○						○										○								
TOS7210S	○	○																							○	
TOS3200									○			○									○					
TOS8030	○	○		○			○						○													
TOS1200														○		○										
149-10A															○											○
RL01-TOS														○	○	○										

: Required the converting adapter "DD-5p/6p" : Allows to use within the cable rating : Required the converting adapter "DD-5p/9p"

Battery Impedance Meter

BIM1000 Series

RS232C USB CE

*Refer to page 8

Easy & Reliable Battery Measurements

Ever-changing battery technology requires batteries powering electric vehicles to have high voltage, high power and low impedance. The Battery Impedance Meter, or BIM1000 Series, is capable of measuring up to 1000 V of test voltage for simultaneous measurements of both battery voltage and resistance at high speeds. The BIM is the ideal equipment for power battery development research and production tests.

Lineup

BIM1030
BIM1100

Dimensions / Weight

214(8.43″)W × 80(3.15″)H × 300(11.81″)D mm(inch) /
3 kg(6.61 lbs)

Accessories

Power cable, For Safety documents, Packing list, CD-ROM

Options

- Clip-type four-wire test lead TL01-BIM
- Pin-type four-wire test lead TL02-BIM
- Zero adjustment tool OP01-BIM

Features

- Maximum voltage measurement: 1000 V max. (BIM1100), 300 V max. (BIM1030)
- Voltage measurement accuracy: ±(0.01 % of reading +3 digit)
- Resistance measurement accuracy: ±(0.5 % of reading +5 digit)
- Resistance measurement ranges: 3 mΩ/30 mΩ/300 mΩ/3 Ω
- High resolution: Voltage 10 μV(6 V range), Resistance 0.1 μΩ(3 mΩ range)
- Measurement frequency: 1 kHz ±0.2 Hz
- Sampling speed(Resistance & voltage simultaneous measurements): 20 ms(FAST)
- Zero Adjustment Function: Effective for decreasing measurement error.
- Measurement logging(500 pairs) and collective transfer function
- SIGNAL I/O, RS232C and USB as standard interface
- New high visibility color display.

Specifications

Voltmeter

Item		BIM1030	BIM1100
Rated input		±300 V	±1000 V
Range		6 V, 60 V, 300 V, AUTO	6 V, 60 V, 600 V, 1000 V, AUTO
Maximum display value *1	6 V range	±6.30000 V	±6.30000 V
	60 V range	±63.0000 V	±63.0000 V
	300 V range	±315.000 V	–
	600 V range	–	±630.000 V
	1000 V range	–	±1050.00 V
Resolution	6 V range	10 μV	10 μV
	60 V range	100 μV	100 μV
	300 V range	1 mV	–
	600 V range	–	1 mV
	1000 V range	–	10 mV
Accuracy *2		±(0.01 % of reading + 3 digit)	
Temperature coefficient		±(0.001 % of reading + 0.3 digit) /°C	

Resistance Meter

Item		BIM1030	BIM1100
Measurement method		Four-terminal measurement method	
Range		3 mΩ, 30 mΩ, 300 mΩ, 3 Ω, AUTO	
Maximum display value *1	3 mΩ range	3.1000 mΩ	
	30 mΩ range	31.000 mΩ	
	300 mΩ range	310.00 mΩ	
	3 Ω range	3.1000 Ω	
Resolution	3 mΩ range	0.1 μΩ	
	30 mΩ range	1 μΩ	
	300 mΩ range	10 μΩ	
	3 Ω range	100 μΩ	
Measured current *3	3 mΩ range	100 mA	
	30 mΩ range	100 mA	
	300 mΩ range	10 mA	
	3 Ω range	1 mA	
Measurement frequency		1 kHz ±0.2 Hz	
Accuracy *4		±(0.5 % of reading + 5 digit)	
Temperature coefficient	3 mΩ range	±(0.05 % of reading + 1 digit) /°C	
	30 mΩ range	±(0.05 % of reading + 0.5 digit) /°C	
	300 mΩ range	±(0.05 % of reading + 0.5 digit) /°C	
	3 Ω range	±(0.05 % of reading + 0.5 digit) /°C	

Sampling Time

Item		BIM1030	BIM1100
Sampling speed	Power supply frequency 50 Hz	FAST: 20 ms, MID: 50 ms, SLOW: 160 ms	
	Power supply frequency 60 Hz	FAST: 20 ms, MID: 42 ms, SLOW: 150 ms	

Judgment Function

Item		BIM1030	BIM1100
Judgment method		Window comparator method. Judgment made with software.	
Resistance	Setting range	0.0000 Ω to 3.1000 Ω	
	Resolution	100 μΩ	
Voltage	Setting range	0.000 V to 315.000 V	0.00 V to 1050.00 V
	Resolution	1 mV	10 mV

Other Functions

Item		BIM1030	BIM1100
Trigger Function		Select external trigger (EXTERNAL) or internal trigger (INTERNAL).	
	INTERNAL	Measures at the sampling speed (FAST, MID, SLOW) interval.	
	EXTERNAL	Starts measurement with a SIGNAL I/O connector signal, *TRG, or the SNGL TRG key on the front panel	
	Trigger delay	0 to 9.999 s, OFF	
	Accuracy	±0.2 ms	
Average function		The average count can be set between 2 and 99. OFF setting available.	
Memory function		Saves up to 100 sets of measurement conditions.	
key lock		Locks the key operation.	
Zero adjustment		Zero adjustment of the voltmeter and resistance meter. OFF setting available. Zero point clear function available.	
	Adjustment rang	1000 digit	

Interface

Item	BIM1030	BIM1100
RS232C	D-SUB 9-pin connector, EIA-232-D compliant	
USB	Complies with USB Specification 2.0. 12 Mbps max. (Full Speed)	
SIGNAL I/O	D-SUB 25-pin connector.	

General Specifications

Item		BIM1030	BIM1100
Environment	Installation location	Indoors, 2000 m or less	
	Spec guaranteed range	Temperature: 18 °C to 28 °C (-4 °F to 158 °F) Humidity: 20 %rh to 80 %rh (no condensation)	
	Operating range	Temperature: 0 °C to 40 °C (32 °F to +122 °F) Humidity: 20 %rh to 80 %rh (no condensation)	
	Storage range	Temperature: -10 °C to 60 °C (-4 °F to 158 °F) Humidity: 90 %rh or less (no condensation)	
Power supply	Input voltage range	85 Vac to 264 Vac (100 Vac to 240 Vac)	
	Input frequency range	47 Hz to 63 Hz	
	Rated power	30 VA	
Isolation voltage		±300 V max	±1000 V max
Insulation resistance (between AC LINE and chassis)		30 MΩ or more (500 Vdc)	
Withstanding voltage	Between the AC LINE and the chassis	1500 Vac for 1 minute, 10 mA or less	
	Between all the measurement terminals and the chassis	2000 Vdc for 1 minute, 1 mA or less	
	Between all the measurement terminals and SIGNAL I/O	2000 Vdc for 1 minute, 1 mA or less	
Electromagnetic compatibility (EMC)		Complies with the requirements of the following directive and standards. EMC Directive 2014/30/EU EN 61326-1 (Class A), EN 55011 (Class A, Group 1), EN 61000-3-2, EN 61000-3-3	
Safety		Complies with the requirements of the following directive and standards. Low Voltage Directive 2014/35/EU EN 61010-1 (Class I, Pollution Degree 2), EN 61010-2-030, EN 61010-031	

*1. Displays OVER when the measurement range is exceeded.
*2. Add ±2 digit when the sampling speed is set to FAST or MID.
*3. Within error ± 10 %.
*4. Add ±3 digit when the sampling speed is set to FAST and ±2 digit when the sampling speed is set to MID.

Digital Multimeter

DME1600

USB GPIB (DME1600GC)

6 1/2 digit resolution, Essential device of "Electronic Measurement" Supporting basic measurement with variety of options

The DME1600 is a digital multi-meter with a resolution of 6 1/2 digit. It can be performed up to 2000 times per second at the setting condition of 4 1/2 digit as fastest measurement, and it can measures 50 times per second when it is set for the 6 1/2 digit. The DME1600 offers fully function of measurement for the voltage, current, resistance, frequency and temperature which can be used various application of measurement and evaluation in design, development and debugging of electronics devices. The DME1600 provides USB and GPIB interface* as standard feature for automated measurement besides manual operation.
Furthermore, the DME1600 offers wide range of options such as 20-channel multi-point scanner card supporting the basic measurement.

Lineup

DME1600
DME1600GC (with GPIB)

Dimensions / Weight

224(8.82″)W × 113(4.45″)H × 373(14.69″)D mm(inch) / 3.7kg(8.16lbs)

Accessories

Power cable(with 3P plug), Test Lead(1 each for Red, Black), USB cable, CD-R(Contains Operation Manual, Application Software), For Safety documents, Packing list

Features

- Resolution: 6 1/2 digit
- Display: 5 x 7 dot matrix VFD, dual display with 3-color
- Basic measurement function: DC voltage[0.1 V, 1 V, 10 V, 100 V, 1000 V], AC voltage [0.1 V, 1 V, 10 V, 100 V, 750 V], DC current [10 mA, 100 mA, 1 A, 3 A], AC current [1 A, 3 A], 2-wire/4-wire resistance [100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ], Frequency [3 Hz to 300 kHz], Continuity test, Diode test, Temperature test
- Built-in USB Interface (GPIB Interface*: selected model)
  *Model with GPIB Interface: DME1600GC

Options

- 20-channel multi-point scanner card DME1600-OPT09
- 10-channel multi-point scanner card DME1600-OPT01
- 10-channel thermocouple multi-point scanner card DME1600-OPT12
- Kelvin probe(for 4-wire resistance measurement) DME1600-OPT07
- 4-wire test lead DME1600-OPT08
- Thermocouple adapter DME1600-OPT02
- K type thermocouple cable DME1600-OPT11

Specifications

DC Characteristics
Accuracy *1

DC Voltage			
Range	Resolution	Input Resistance	1 year (23 °C ± 5 °C)
100.0000 mV	0.1 µV	> 10 GΩ	0.0050+0.0035
1.000000 V	1.0 µV	> 10 GΩ	0.0040+0.0007
10.00000 V	10 µV	> 10 GΩ	0.0035+0.0005
100.0000 V	100 µV	10 MΩ	0.0045+0.0006
1000.000 V	1 mV	10 MΩ	0.0045+0.0010
DC Current			
Range	Resolution	Shunt Resistance	1 year (23 °C ± 5 °C)
10.00000 mA	10 nA	5.1 Ω	0.050+0.020
100.0000 mA	100 nA	5.1 Ω	0.050+0.005
1.000000 A	1 µA	0.1 Ω	0.100+0.010
3.000000 A	10 µA	0.1 Ω	0.120+0.020
Resistance			
Range	Resolution	Test Current	1 year (23 °C ± 5 °C)
100.0000 Ω	100 µΩ	1 mA	0.010+0.004
1.000000 kΩ	1 mΩ	1 mA	0.010+0.001
10.00000 kΩ	10 mΩ	100 µA	0.010+0.001
100.0000 kΩ	100 mΩ	10 µA	0.010+0.001
1.000000 MΩ	1 Ω	5 µA	0.010+0.001
10.00000 MΩ	10 Ω	500 nA	0.040+0.001
100.0000 MΩ	100 Ω	500 nA||10 MΩ	0.800+0.010
Diode Test			
Range	Resolution	Test Current	1 year (23 °C ± 5 °C)
1.0000 V	10 µV	1 mA	0.010+0.020
Continuity			
Range	Resolution	Test Current	1 year (23 °C ± 5 °C)
1kΩ	10 mΩ	1 mA	0.010+0.030

Measuring Characteristics

Item	Specifications
DC voltage measurement: Over range	Capable 20 % of the over range excluding "1,000 V range"
DC voltage measurement: Input bias current	Less than 30 pA (at 25 °C)
DC voltage measurement: Input voltage protection	1,000V for all ranges
DC current measurement: Over range	Capable 20 % of the over range excluding "3 A range"
Resistance measurement: Maximum resistance value for usable test lead	10 Ω (100 Ω range), 100Ω (1 k Ω range), 1 kΩ (Other ranges)
Resistance measurement: Input voltage protection	1,000 V for all ranges

AC Characteristics
Accuracy *2

AC Voltage (TRMS)			
Range	Resolution	Frequency	1 year (23 °C ± 5 °C)
100.0000 mV	0.1 µV	3 Hz to 5 Hz	1.00+0.04
		5 Hz to 10 Hz	0.35+0.04
		10 Hz to 20 kHz	0.06+0.04
		20 kHz to 50 kHz	0.12+0.05
		50 kHz to 100 kHz	0.60+0.08
		100 kHz to 300 kHz	4.00+0.50
1.000000 V to 750.000 V	1.0 µV to 1 mV	3 Hz to 5 Hz	1.00+0.03
		5 Hz to 10 Hz	0.35+0.03
		10 Hz to 20 kHz	0.06+0.03
		20 kHz to 50 kHz	0.12+0.05
		50 kHz to 100 kHz	0.60+0.08
		100 kHz to 300 kHz	4.00+0.50
AC Current (TRMS)			
Range	Resolution	Frequency	1 year (23 °C ± 5 °C)
1.000000 A	1 µA	3 Hz to 5 Hz	1.00+0.04
		5 Hz to 10 Hz	0.30+0.04
		10 Hz to 5 kHz	0.10+0.04
3.000000 A	10 µA	3 Hz to 5 Hz	1.10+0.06
		5 Hz to 10 Hz	0.35+0.06
		10 Hz to 5 kHz	0.15+0.06

Measuring Characteristics

Item	Specifications
Over range	Capable 20 % of the over range excluding "750 V RMS range"
Measuring frequency	750 V RMS Range is limited to100 kHz

Frequency and Period
Accuracy *3

Range	Frequency	1 year (23 °C ± 5 °C)
100 mV RMS to 750 V RMS	3 Hz to 5 Hz	0.10
	5 Hz to 10 Hz	0.05
	10 Hz to 40 Hz	0.03
	40 Hz to 300 kHz	0.01

Measuring Characteristics

Item	Specifications
Over range	Capable 20 % of the over range excluding "750 V RMS Range"
Measuring frequency	750 V RMS Range is limited to100 kHz

General

Item	Specifications
voltage range	100 Vac/120 Vac/220 Vac/240 Vac ± 10 % (single phase)
frequency range	50 Hz/60 Hz ± 10 %
Power consumption	25 VAmax
Operating Temperature range	0 °C to 50 °C
Operating Humidity range	Up to 80 % rh (0 °C to 31 °C, non condensing)
Storage Temperature range	-40 °C to 70 °C
Operating Altitude	Up to 2000 m

*1 • ± (% of reading + % of range)
• 6 1/2 digit resolution, measured by Auto Trigger mode after the unit has been warmed up more than two hours.
• For the resistance measurement, it applies to use either 4-wires resistance measurement or 2-wires resistance measurement of the Null function.
*2 • ± (% of reading + % of range)
• Specifications are for 2-hours warm-up at 6 1/2 digit, slow AC filter with Bandwidth 3 Hz, sine wave input.
• Measured by the sine-wave input exceeding 5 % of the range
• For the input range from 1 % to 5 %, add 0.1 % of the range (when it is less than 50kHz) or adding 0.13 % of the range (when it is from 50 kHz to 100 kHz)
*3 • ± (% of reading)
• 6 1/2 digit resolution, measured after the unit has been warmed up more than two hours.

Function Generator

FGA5050

LAN USB GPIB (FGA5050GC) LXI

50 MHz Arbitrary Waveform Generator

The LXI interface makes easier for the test system!

The FGA5050 is a function generator that equips with the arbitrary waveform function. In addition to Sine waveform, Square waveform, Ramp waveform of those pre-set waveform generation function, the FGA5050 offers to realize high precision waveform with 1 µHz of resolution and 50 MHz of wideband frequency. The FGA5050 can be used in wide application such as "Voltage variation test for Automotive Electronic Components", "ECU false signal source", "Charge-Discharge test for the rechargeable battery", "Ripple super-impose test" and it can be used as the trigger signal for the various type of test system. Further more, three types of interface, LAN / USB / GPIB* are equipped with the FGA5050 as standard feature, it applies for automated test along with manual operation.

Lineup

FGA5050
FGA5050GC(with GPIB)

Dimensions / Weight

253(9.96″)W × 107(4.21″)H × 380(15.0″)D mm(inch) / 4kg(8.8lbs)

Accessories

Power cable(with 3P plug), Pattern generator cable, USB cable, CD-R(Contains Operation Manual, the Communication Interface Manual), For Safety documents(1 each for English, Japanese), Packing list(English/Japanese)

Features

- Wide band frequency
  Sine waveform: 1 µHz to 50 MHz, Square waveform: 1 µHz to 25 MHz
- Sine waveform, Square waveform, Ramp waveform, Triangle waveform, Pulse waveform, Noise waveform, DC, Arbitrary waveform output
- Waveform Editor Application Software "WAVEPATT" is included as standard
- Various modulation types: AM, FM, PM, FSK, PWM, Frequency sweep, Burst, External Modulation Input
- 16 bits, up to 50 MHz pattern out, 14 bits, 256 K points, 125 M Sample/s Arbitrary waveforms
- 10 MHz clock in and out
- Trigger Input and Trigger output (TTL compatible)
- Interface: LAN/USB/GPIB*standard
  *Model with GPIB Interface: FGA5050GC

Specifications

Waveform Characteristic			
Waveform	Standard waveforms	Sine, Square, Ramp, Triangle, Pulse, Noise, DC	
	Built-in arbitrary waveforms	Exponential Rise and Fall, Negative ramp, Sin(x)/x, cardiac	
Sine	Frequency	1 µHz to 50 MHz	
	Amplitude Flatness *1 *2 (Relative to 1 kHz)	0.1 dB (< 100 kHz), 0.15 dB (< 5 MHz), 0.3 dB (< 20 MHz), 0.5 dB (< 50 MHz)	
	Harmonic distortion *2 *3	DC to 20 kHz	-70 dBc (< 1 Vpp), -70 dBC (≥1 Vpp)
		20 kHz to 100 kHz	-65 dBc (< 1 Vpp), -60 dBC (≥1 Vpp)
		100 kHz to 1 MHz	-50 dBc (< 1 Vpp), -45 dBC (≥1 Vpp)
		1 MHz to 20 MHz	-40 dBc (< 1 Vpp), -35 dBC (≥1 Vpp)
		20 MHz to 50 MHz	-35 dBc (< 1 Vpp), -30 dBC (≥1 Vpp)
	Total Harmonic distortion	DC to 20 kHz	≤ 0.06 % (< 0.5 Vpp)
	Spurious *2 *4 (non-harmonic)	DC to 1 MHz	-70 dBc
		1 MHz to 50 MHz	-70 dBc+6 dB/octave
	Phase Noise(10 kHz Offset)	≥ 1 MHz	-115 dBc/Hz typical (≥ 0.1 Vpp)
Square	Frequency	1 µHz to 25 MHz	
	Rise/Fall time	< 10 ns	
	Overshoot	< 2 %	
	Variable Duty Cycle	20 % to 80 % (< 10 MHz), 40 % to 60 % (< 25 MHz)	
		< 25 MHz	40 % to 60 %
	Asymmetry	1 % of period +5 ns (@50 % duty)	
	Jitter (RMS)	200 ps (≥ 0.1 Vpp, ≥ 1 MHz)	
Ramp, Triangle	Frequency	1µHz to 200 kHz	
	Linearity	< 0.1 % of peak output	
	Symmetry	0.0 % to 100.0 %	
Pulse	Frequency	500µHz to 10 MHz	
	Pulse width	20 ns minimum, 10 ns res. (period ≤ 10 s)	
	Variable Edge Time	< 10 ns to 100 ns	
	Overshoot	< 2 %	
	Jitter (RMS)	200 ps (≥ 0.1 Vpp, ≥ 50 kHz)	
Noise	Bandwidth	20 MHz typical	
Arbitrary	Frequency	1µHz to 10 MHz	
	Length	2 to 256 K	
	Resolution	14 bits (including sign)	
	Sample Rate	125 M Sa/s	
	Min Rise/Fall time	30 ns typical	
	Linearity	< 0.1 % of peak output	
	Setting Time	< 250 ns to 0.5 % of finai value	
	Jitter (RMS)	6 ns+30 ppm	
	Non-voltage Memory	4 Waveforms *256 K points	

*including the "Operation Manual" and "Communication Interface Manual".

*1: Add 1/10th of output amplitude and offset spec per °C for operation outside the range of 18 °C to 28 °C
*2: Autorange enabled *3: DC offset set to 0V
*4: Spurious output at low amplitude is -75 dBc typical
*5: Add 1 ppm/°C average for operation outside the range of 18 °C to 28 °C
*6: FSK uses trigger input (1 MHz maximum)
*7: Sine and square waveforms above 10 MHz are allowed only with an "infinite" burst count

Common Characteristic		
Frequency	Resolution	1 µHz
Amplitude	Range	10 mVpp to 10 Vpp in 50Ω
		20 mVpp to 20 Vpp in No Load (open-circuited)
	Accuracy *2 *5	±1 % of setting ± 1 mVpp (at 1 kHz)
	Units	Vpp, Vrms, dBm
	Resolution	4 digits
DC Offset	Range	±5 V in 50 Ω
		±10 V in No Load (open-circuited)
	Accuracy *2 *5	±2 % of offset setting ±0.5 % of amplitude setting ±2 mV
	Resolution	4 digits
Main Output	Impedance	50 Ωtypical
	Isolation	42 Vpeak maximum to earth
	Protection	Short-circuit protection, Stop the output automatically at the state of over-load
Internal Frequency	Accuracy *5	±10 ppm in 90 days, ±20 ppm in 1 years
External Frequency Input	Lock Range	10 MHz ± 500 Hz
	Level	100 mVpp to 5 Vpp
	Impedance	1 kΩtypical, AC coupled
	Lock Time	< 2 sec
External Frequency Output	Level	632 mVpp (0 dBm) typical
	Impedance	50 Ω typical, AC coupled
	Lock Range	10 MHz
Phase Offset	range	-360 ° to +360 °
	Resolution	0.001°
	Accuracy	8 ns

Modulation		
Modulation Type	AM, FM, PM, FSK, PWM, SWEEP and BURST	
AM	Carrier	Sine, Square, Ramp, Arb
	Source	Internal/External
	Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
	Frequency (Internal)	2 mHz to 20 kHz
	Depth	0.0 % to 120.0 %
FM	Carrier	Sine, Square, Ramp, Arb
	Source	Internal/External
	Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
	Frequency (Internal)	2 mHz to 20 kHz
	Deviation	DC to 25 MHz
PM	Source	Internal/External
	Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
	Frequency (Internal)	2 mHz to 20 kHz
	Deviation	0.0 ° to 360 °
PWM	Carrier	Pulse
	Source	Internal/External
	Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
	Frequency (Internal)	2 mHz to 20 kHz
	Deviation	0 % to 100 % of pulse width

Modulation		
FSK	Carrier	Sine, Square, Ramp, Arb
	Source	Internal/External
	Internal Modulation	50 % duty cycle Square
	Frequency (Internal)	2 mHz to 100 kHz
External Modulation Input *6	Voltage Range	±5 V full scale
	Input Resistance	8.7 kΩ typical
	Bandwidth	DC to 20 kHz
SWEEP	Waveforms	Sine, Square, Ramp, Arb
	Type	Linear, Log
	Direction	Up or Down
	Sweep Time	1 ms to 500 s
	Trigger Source	Internal, External or Manual
	Marker	Falling edge of sync signal (programmable frequency)
BURST	Waveforms*7	Sine, Square, Ramp, Triangle, Noise, Arb
	Type	Internal/External
	Start/Stop Phase	-360 ° to +360 °
	Internal Period	1µs to 500 s
	Gated Source	External trigger
	Trigger Source	Internal, External or Manual
Trigger Input	Level	TTL compatible
	Slope	Rising or Falling (Selectable)
	Pulse width	≥ 100 ns
	Impedance	≥ 10 kΩDC coupled
	Latency	< 500 ns
Trigger Output	Level	TTL compatible into ≥ 1 kΩ
	Pulse width	≥ 400 ns
	Impedance	50 Ω typical
	Maximum rate	1 MHz
	Fan-out	≤ 4 FGA5050s

Pattern Mode Characteristic		
Output	Clock Maximum Rate	50 MHz
	Output Level	TTL compatible into ≥ 2 kΩ
	Output mpedance	110 Ω typical
	Pattern Length	2 to 256 K

General	
voltage/frequency range	100 Vac to 240 Vac (single phase), 50 Hz/60 Hz
Power consumption	80 VAmax
Operating Temperature/ Humidity range	0 °C to 55 °C (80 %rh or less, no condensation)
Storage Temperature range	-30 °C to 70 °C (80 %rh or less, no condensation)
Operating Altitude	Up to 2000 m

Digital Power Meter

KPM1000

USB OPTION GPIB OPTION RS232C

Dimensions / Weight

214(8.43″)W × 81(3.19″)H × 270(10.63″)D mm(inch) / 2.5kg(5.51lbs)

Accessories

AC power cable, Safety plug, CD-R(Contains Operation Manual, Application Software), Quick start(1 each for English, Japanese), For Safety documents, Packing list

Options

■ Test Lead
TL40
■ Safety plug
TL41 (connection by the screw)
TL42 (connection by the solder)
TL43 (connection by the clamp)
■ Alligator clip
TL44
■ Fork terminal adapter
TL45
■ Application software
(Complied to the testing of IEC62301 Ed1.0)

■ AC receptacle cable
OT01-KPM
■ AC Multi Outlet Cable
OT02-KPM
■ Rack mount adapter
KRA2 (EIA)
KRA100 (JIS)
■ Interface Board
With GPIB factory option
With USB factory option

*Only one interface board can be installed.

Accurate and reliable power measurement over a wide power range!

The digital power meter, KPM1000, is a measuring instrument that measures the single phase power applied to the extended range from the small consumption such as a standby power to the large scale consumption of power. Through the years, each region of the world has been putting their effort to establish the regulation related to the ecological design such as “ErP Directive” in Europe, “Energy Star” in the US, “Top Runner Method” in Japan, and those standards are widely used by commercial companies while taking advantage from other products as well as an effort to the environment issues. In the “ErP Directive Lot6”, it applies to the standby power consumption (classified in the “Off-mode” and “Standby mode”) of home appliances, and office equipments, and it is required to issue the declaration of conformity for the CE marking.
The KPM1000 complies to the standard of IEC62301 Ed1.0 (Household electrical appliances - Measurement of standby power) and it is capable to measure the standby power consumption required by the “ErP Directive Lot6”. The KPM1000 is a compact , light-weight, low price, and capable to operate with the optional interface (some interfaces are available in factory option). The KPM1000 comes in handy for measuring the power of equipments, and it can be used as an essential device for the test system.

Features

■ Measurement of the standby power consumption
■ High precision measurement - Basic accuracy of the Voltage, Current, Power ±(0.1% of reading + 0.1% of range)
■ The dedicated application software(free download from the Web site) enables you to control the KPM1000 through the PC as same as panel operation.
■ Displays 4 measuring items at the same time
■ Easy operation

Specifications

● Input
Number of input channels...1
Measurement line.....Single-phase, 2 wires
Input terminal.....Voltage input: Safety terminal, Current input: M6 terminal board
Measured rated voltage ....300 Vrms (Measurement categories CAT II *1)
Measured rated current.....20 Arms
Maximum allowable input .Voltage: 900 Vpk or 360 Vrms, Current: 120 Apk or 24 Arms
Input impedance.....Voltage input: 6 MΩ ±10 %, Current input: less than 2 mΩ
Voltage between the earth...300 V
● Measuring items.....Voltage, Current, Active power, Apparent power, Reactive power, Power factor, Phase angle, Frequency, Accumulated current, Accumulated power, Positive direction accumulated power, Negative direction accumulated power, Accumulated time, Voltage crest factor, Current crest factor, Voltage peak, Current peak
● Display interval .....100 ms/200 ms/500 ms/1 s/2 s/5 s/10 s
● Number of display digits....5 digits (display A, C), 7 digits (display B, D)
● Measuring range .....30 Hz to 500 Hz/30Hz to 10 kHz (Selects from the Line filter ON/OFF)
● Voltage measurement *3
Ranges.....150 V/300 V (Auto range available)
Allowable crest factor 3
Resolution.....0.01 V
Basic accuracy *2 .....± (0.1 % of reading + 0.1 % of range)
● Current measurement *3
Ranges.....Direct input: 5 m/10 m/20 m/50 m/100 m/200 m/500 m/ 1/2/5/10/20 A (Auto range available)
Allowable crest factor 6
Resolution.....0.0001 mA (In “5 mA” range), 0.001 mA (In “10 m/ 20 m/ 50 mA” range), 0.01 mA (In “100 m/200 m/500 mA” range), 0.1 mA (In “1/2/5 A” range), 1 mA (In “10/20 A” range)
Basic accuracy *2 .....± (0.1 % of reading + 0.1 % of range)
● Power measurement *4
Ranges *5 .....750 m/1.5/3/6/7.5/15/30/60/75/150/300/600/750/1.5 k/3 k/6 kW
Resolution.....0.01 mW (In “750 mW” range), 0.1 mW (In “1.5/3/6/7.5 W” range), 1 mW (In “15/30/60/75 W” range), 0.01 W (In “150/300/600/750 W” range), 0.1 W (In “1.5 k/3 k/6 kW” range)
Basic accuracy *2 .....± (0.1 % of reading + 0.1 % of range)
● Frequency measurement
Displays .....10.000 Hz to 10.000 kHz
Applied devices for the measurement...Voltage/Current
Accuracy .....± (0.06 % of reading)
● Other features.....Averaging function, Accumulated time setting function, Synchronized source (voltage/current) selector, display hold function, scaling function (for CT, PT)
● Communication interface functions .....RS232C (standard), GPIB/USB (factory option, select either the one or the other)
● AC input
Nominal input rating .....100 V to 240 V, 50 Hz to 60 Hz
Voltage range .....90 V to 250 V
Maximum power consumption...70 VA
● Temperature range
Range of guaranteed rating...+18 °C to +28 °C
Operating temperature range ..0 °C to +40 °C

*1: Applies to the measurement of device connected with the low voltage facilities, it is indicated for the primary circuit of device such as home appliances, power tools of which power cable is connected to the receptacle.
*2: [45 Hz ≦ f ≦66Hz]
At effective input range, 6 months after calibration, temperature 23 °C ±5 °C, Sine wave, Power factor 1, common mode voltage 0 V. The error may be occurred when the wave form is an asymmetrical sine-wave (such as half-wave rectification waveform, full-wave rectification waveform). For other frequencies, refer to the detailed specification sheet.
*3: Effective input range is 1 % to 120 % of the specified range
*4: Effective input range is 1 % to 144 % of the specified range
*5: Combined with the voltage range and the current range

High Voltage Digital Voltmeter

149-10A

Dimensions / Weight

134(5.28″)W × 164(6.46″)H × 270(10.63″)Dmm(inch) / 3kg(6.61 lbs.)

Features

- Measurement of high voltages (AC/DC) of up to 10 kV maximum.
- High measuring accuracy and input resistance
- Excellent ease of maintenance

Specifications

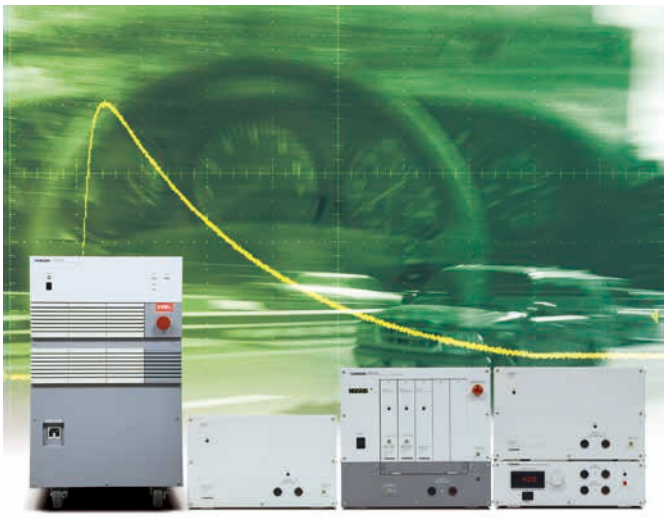
Display ····· 4 1/2 digits
[DC voltage]
Measuring range ..... 0.5 kV to 10.000 kV
Accuracy····· ± (0.5 % of reading +0.03 % of range)
[AC voltage]
Measuring range ..... 0.5 kV to 10.000 kV
Accuracy····· ± (1 % of reading +0.05 % of range)
Input impedance ····· 1000 M Ω ± 2 %
Sampling ····· 3 times/s

Options for Measuring Instruments

- GPIB cable
  - 408J-101 Cable length: 1 m
  - 408J-102 Cable length: 2 m
  - 408J-104 Cable length: 4 m

EMC Test System for Automotive Electronics

KES7000 system



Voltage variation simulator in this photo (left) is for 12.5 A.

Complying with International Standards! Best Suited to EMC Testing for Automotive Components

The KES7000 System is a conductive immunity test system that is fully compliant with ISO7637-2 and ISO7637-3, international standards for EMC testing required for automotive electronic components. This system consists of the KES7700 Series Transient Surge Tester, KES7400A Series Voltage variation simulator and KES7100 application software dedicated to the KES7000 system. This product configuration supports JASO standards and the special test requirements of car manufacturers with options or custom orders.

●KES7700 Series: Transient surge tester

Transient Immunity Tester KES7700 Series are transient surge tester that utilizes a compact unit system. A surge generator circuit is installed for each pulse unit as the tester meets the requirement of ISO7637-2, ISO7637-3, ISO16750-2, JASO D001, SAE J1113, and other standards. The KES7700 Series meets a broad range of independent automobile manufacturer standards as well.
The ISO7637 standard specifies Pulse 1, Pulse 2a, and Pulse 3a/3b, while the ISO16750-2 standard specifies Pulse 5a/5b. Each pulse simulates the following: electromagnetic phenomena produced by electronic equipment joined by wire harnesses during an automobile's normal operation, electromagnetic coupling during switch opening and closing, and load dump surges produced by the alternator when the battery is disconnected. Each pulse also tests the tolerance of on-board electronic equipment. In this testing, malfunctions and breakdowns involving on-board electronic equipment are evaluated.

Features

- Fully complies with ISO7637-2.2011,ISO7637-3.2007,ISO16750-2.2010.
- Load dump suppressor for Pulse 5b generation.
  The Pulse 5a uses an amp circuit method for output and a load dump suppressor for Pulse 5b generation to fully comply with the ISO 7637 standard.
- Compact frame by module system
- Bus-Bar System
- Two types of CDN (60 V/50 A and 60 V/100 A) are available.
- Application software to set test conditions and control the tester.
- JASO D001-94 pulse unit offered as an optional module.

* For information about support for individual car manufacturers' standards, please consult with us.

Lineup

■ Transient Immunity Tester (KES7700 Series) Compliant with the ISO 7637-2 Standard (ISO 7637-2.2011), ISO 7637-3 Standard (ISO7637-3.2007) (ISO16750-2.2010)

Model name	Product name	Specifications
KES7702	Main frame 50A	KES7700 Series main frame/built-in 50A CDN
KES7703	Main frame 100A	KES7700 Series main frame/built-in 100A CDN
KES7711A	Pulse module 1-12BP	ISO 7637-2 Pulse 1 waveform/12 V, bipolar output type
KES7713B	Pulse module 1-24BP	ISO 7637-2 Pulse 1 waveform/24 V, bipolar output type CDN50A
KES7714	Pulse module 1-24BP	ISO 7637-2 Pulse 1 waveform/24 V, bipolar output type CDN100A
KES7721	Pulse module 2aBP	ISO 7637-2 Pulse 2a waveform/12 V, 24 V, switchable to 2, 4, and 10 Ω, bipolar output type
KES7731	Pulse module 3a/3b	ISO 7637-2 Pulse 3a/3b waveform/12 V, 24 V, 100 kHz sweep supported
KES7750	Pulse module 5a/5b	ISO 7637-2 Pulse 5a/5b waveform/12 V, 24 V CDN50A
KES7751	Pulse module 5a/5b	ISO 7637-2 Pulse 5a/5b waveform/12 V, 24 V CDN100A
SPEC80677	Load dump suppressor	10 to 100 V suppress Volt CDN50 A
SPEC80678	Load dump suppressor	10 to 100 V suppress Volt CDN100 A
KES7300	Capacity coupling clamp	Capacity coupling clamp 20-dB attenuator for Pulse 3a/3b

■ Options

Model name	Product name	Specifications
SPEC80254	Blank panel	Used for the main frame (Included 2 pcs. for the unit)
SPEC80265A	Waveform measurement resistor	2 Ω (for Pulse 2a and Pulse 5a)
SPEC80266A	Waveform measurement resistor	10 Ω (for Pulse 1/12 V)
SPEC80267A	Waveform measurement resistor	50 Ω (for Pulse 1/24 V)
SPEC80268A	Waveform measurement adapter	No-load waveform measurement adapter
	Alarm lamp	Used for transient surge testing
	Test environment facilities	For details, please contact us.
SPEC80488	Waveform measurement resistor	20 Ω (for Pulse 1/24 V)
SPEC80617	Waveform measurement resistor	4 Ω (for Pulse 2a)

SPEC80677/SPEC80678: Pulse 5b Load Dump Suppressor

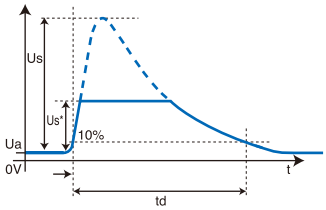
SPEC80677/SPEC80678 is a suppressor that generates pulse 5 b required by the ISO 16750-2 standard. When connected with the pulse 5a/5b module (KES7750/7751), it lets you set a suppressed voltage of up to 100 V in steps of 0.1 V.

Features

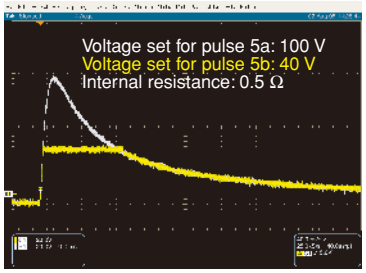
■Suppressed voltage: 100 V max. (settable in steps of 0.1 V)
■The waveform required by the standard can be output accurately without changing the pulse width (td) that is set for pulse 5a.
*The above applies only when Kikusui's pulse 5a/5b module (KES7750/7751) or an amplifier circuit-based pulse 5a generator is used.

Item	Specification
Maximum input surge voltage (UA)	200 V Max
Maximum suction surge current	300 A Max
Settable suppressed voltage range (Us*)	10 to 100 V, in steps of 0.1 V (accuracy: (±3.0 V) Us* > Ua

Pulse5b



Actual waveform



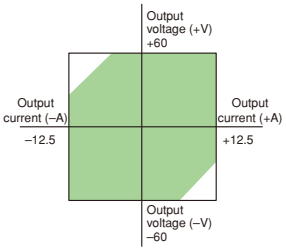
●KES7400A Series: Voltage variation simulator

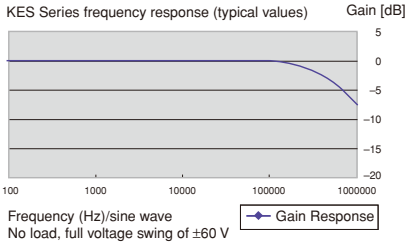
The KES7400A Series comes in a single cabinet that consists of a Signal Generator module (including an arbitrary pulse generator), which combines our power supply technology and EMC technology, and a high-speed bipolar power supply module. Many automotive electronic devices have long wire harnesses and inductive load characteristics, as do motors, or capacitive load characteristics with a large-capacity capacitor connected between the input and ground. In the case of these devices, general DC power supplies exceed the linear operation range, potentially making it impossible to obtain the desired waveform output. Considering this problem, it is common to use a bipolar power supply for automotive EMC testing.

Features

- Bipolar power supply supporting a maximum range of ±60 V at ±50 A
- The frequency response is 100 kHz (full voltage swing of ±60 V, no load)and the internal impedance response is 20 mΩ or less *1
- The main unit of the power supply contains an arbitrary pulse generator
- Rise/fall time: 1 µs min. (square wave, full voltage swing of (60 V, no load)
- Synchronous output tests can be conducted on up to 4 channels
- The tester is capable of catering to individual auto makers'test requirements (except for extremely rare ones)

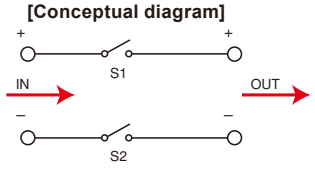
*1: The power supply specifications of the ISO 7637-2 standard stipulate that the internal impedance must be 10 mΩ or less for DC at 400 Hz. Also, the same standard specifies that the impedance must be 0 to 0.05 Ω for Pulse 2b and 0 to 0.02 Ω for Pulse 4.





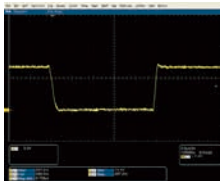
High-speed disconnection testing possible using a switch module: DC cut time of "1 µs or less"

The KES7400A Series may contain a switch module that is available as a factory option. This switch module simulates an instantaneous power cut due to poor contact or other factor that may arise in an automotive electronic device connected to the wire harness. There are three disconnection modes that can be selected (anode mode, cathode mode, and two-electrode mode). Power can be disconnected by turning on or off either the anode (S1) or cathode (S2) switch or both.



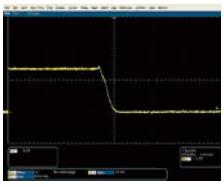
Item	Specification
Circuit disconnection switch	2 electrodes (anode and cathode)
Switch voltage and current	60 VDC max./The current value depends on the current capacity of the model in use.
Switch ON time	1 µs or less at 1 kΩ load
Switch OFF time	1 µs or less at 1 kΩ load

[Overall waveform]



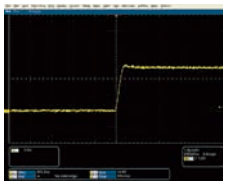
Measured value: Pulse width 9.74 µs

[Falling waveform]



Measured value: Fall time 0.61 µs

[Rising waveform]



Measured value: Rise time 0.31 µs

Lineup

■ **Voltage variation simulator (KES7400A Series)**

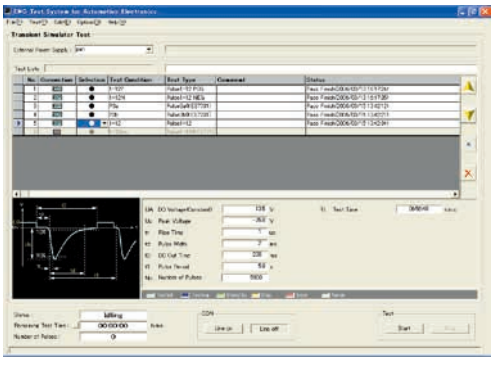
Model name	Specifications	Model name	Specifications
KES7400A *2	±60 VDC ±12.5 A max.	KES7410A *3	±60 VDC ±12.5 A max.
KES7401A *2	±60 VDC ±25 A max.	KES7411A *3	±60 VDC ±25 A max.
KES7402A *2	±60 VDC ±37.5 A max.	KES7412A *3	±60 VDC ±37.5 A max.
KES7403A *2	±60 VDC ±50 A max.	KES7413A *3	±60 VDC ±50 A max.

■ **Options**

Model name	Product name	Specifications
SPEC80256	Synchronous operation cable	Used when operating supply voltage variations testers in synchronous mode (Included 1 pcs. for the unit)

*2: A 100 A or 200 A power supply can be offered on request.
*3: With the optional switch module

●KES7100: Application Software



Features

- Up to 50 test conditions can be registered in a test execution list, and tests are carried out in accordance with the list
- For transient surge testing, up to seven types of pulse modules can be controlled
- For voltage variations testing, up to four testers can be controlled for synchronous operation by communicating with a single tester
- Voltage variations test: ISO 7637-2 Pulse 2b, Pulse 4, arbitrary waveform generation, waveform libraries catering to individual auto makers'test requirements (Option)
- In addition to those compliant with the ISO 7637-2.2004 standard, a variety of waveforms can be generated easily (for voltage variations testing)
- The created test execution list can be saved in a file along with comments
- The result of the OK/NG judgment that the user makes at the end of each test can be saved in the execution list
- The RS232C interface is supported for communication

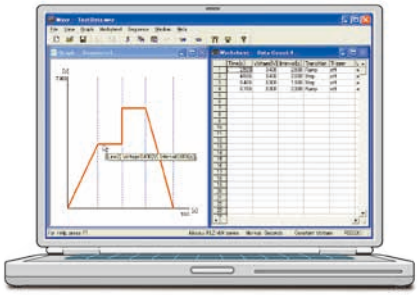
Lineup

■ **Application Software**

Model name	Specifications
KES7100 (E)	Integrated application software for the KES7000 system

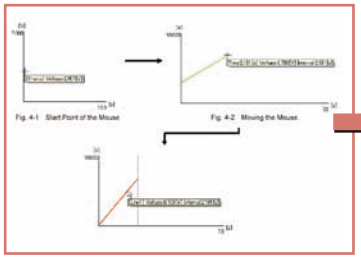
Application Software for Power Supplies and Electronic Loads

WAVY Series

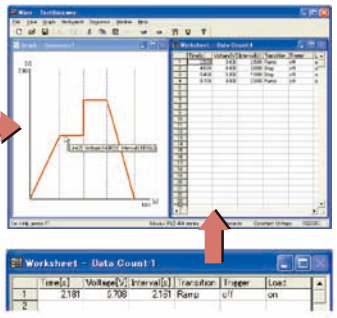


Easy-to-operate software expanding functions of power supplies and electronic loading units

WAVY is sequence creation software that supports the power supplies and electronic loads from KIKUSUI Electronics Corp.
You can use WAVY to create and edit sequences easily with a mouse. During sequence execution, you can also display execution points for visualization to monitor voltage, current, and other parameters and save them as a file.



Data now created with a mouse is displayed as shown on the right.



* When adding data, you can also enter the data directly in data cells.

Features

- Easy operation for waveform images by using a mouse
- Sequence data can be edited easily
- Sequence data can be stored easily
- Four types of interfaces are available (USB,LAN,RS232C,GPIBs from NI, INTERFACE, and CONTEC)
- Text files can be read freely

Lineup

- WAVY for PAS & PWR
- WAVY for PAV(SD024-PAV)
- WAVY for PBZ
- WAVY for PAT-T
- WAVY for PLZ-5W(SD023-PLZ-5W)
- WAVY for PLZ-5WH2(SD033-PLZ-5WH2)
- WAVY for PLZ-4W
- WAVY for PCZ1000A
- WAVY for PLZ-U
- WAVY for PCR-LE(SD011-PCR-LE)
- WAVY for PCR-WE(SD032-PCR-WE)
- WAVY for PWX(SD013-PWX)
- WAVY for PMX(SD025-PMX)
- WAVY for PWR-01(SD027-PWR-01)*

*For PWR-01, currently support 400 W, 800 W, 1200 W models only. (2000 W models to be covered later)

Operating Environment

- CPU: Pentium IV or later (Core 2 or later)
- OS/Memory: Refer to the website for the latest information available.
- Interface: RS232C. An RS232C cross-over cable is required.

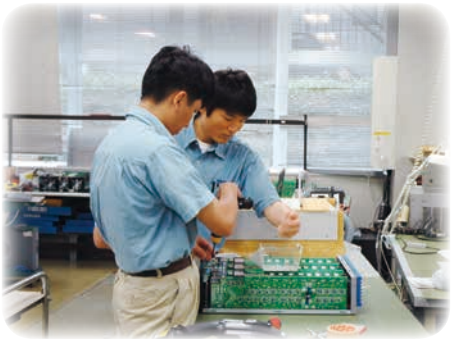
DRIVERS

The instrument drivers uploaded on our website are free to download for your convenience.

	IVI-COM	IVI-C	VisualBasic 6.0	LabVIEW	Lab Windows/CVI
Test and Measurement Instruments					
KDS6-0.2TR	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
KFM2030/2005	✔		✔ (IVI-COM)		
TOS6210/6200A			✔		
TOS5300 Series	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
Power Supply Controllers					
PIA4800 Series	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
DC Power Supplies					
PWR-01 Series	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PAT-T Series	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PBZ Series	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PWX Series	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PMP Series	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PMX-A Series	✔(IviDCPwr)	✔(IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
AC Power Supplies					
PCR-LE/PCR-LE2 Series	✔(IviACPwr)	✔(IviACPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PCR-MA Series	✔(IviACPwr)	✔(IviACPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
Electronic Loads					
PLZ Series (5W/5WH/5WH2/4W/4WL/4WH/U)	✔	✔	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PCZ1000A	✔	✔	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
Common Libraries					
VISA	KI-VISA				
IVI	IVI Shared Components				

Note: For details of the operation condition, please refer to our web site.

The Customized/System solution realized with Kikusui strength having both technologies, Measurement & Power Supply.



To meet with the various application of individual customer's request, Kikusui offers to provide most suitable design of the system not limited to standard product items.

We have designed and delivered various custom products and systems to the wide range of customers from the field of R&D to the Production, QA, Service in the industry of Automotive, Telecommunication, components devices to apply for such testing requirement of evaluation, compliance with standard which were required based on the system of Electronic loads and Power Supplies.

In case if you require any special application of the testing system which were not perfectly found in our standard specification of product line, please ask for your local sales representative, we surely would provide our best proposal to meet your request by combining our established engineering of technology in Measuring instruments and Power Supplies at our original point of view.

Field of business industry/Application

*Please ask for our sales representative even if your requirement may not be complied with following categories.

■ Controlling various devices and the Power Supply (Electronic Load)
System for the reliability evaluation testing.
- Automobile ····· Various Electronic devices
- Electronic Components ····· PDP, LCD panel
- Telecommunication ····· Switching box, terminal station, equipped device for the satellite
- R&D, Medical ····· Accelerator Control
- Power Supply Tester ····· High Voltage, Large Capacity, Multi Output
- Others ····· Chemical synthesis, metal plating

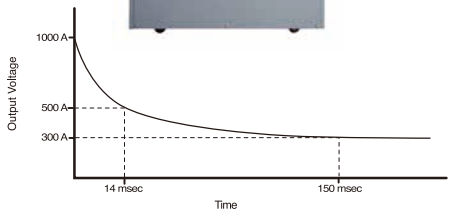
■ Charge-Discharge test system for the evaluation test for various batteries.
- EV(Electric Vehicle) related application ····· High performance battery for vehicle equipped motor, measuring for power efficiency
- Fuel Cell related application ····· Single Cell, Stack Cell, I/V Characteristics test
- Medical related application ····· Battery for small health equipment
- Telecommunication related application ····· Cell phone, battery for the terminal devices
- Material related application ····· An Electrode, Chemical synthesis

■ Test system for the Standard/Regulation Compliance application.
- Harmonic Current measuring
- Flicker Test
- Immunity Test
- Automated Hipot, Insulation Test

Special order items

Inrush current power supply (For vehicle electronic parts test)

This is a constant voltage generating device that secures a rush load current operation region (with time restriction) in order to test loads such as starter motors, lamps, etc. that transiently require a lot of current. Addition of the output impedance variable function that changes the output voltage according to the output current is also available. (The photograph shows an example of DC20 V-300 A (1000 A at peak)model.



300 Wx5ch constant current electronic load system (For vehicle electronic parts test)

This is a multichannel electronic load system containing 5 channels of the electric load part of the 300 W rated current per device.
In this device, the constant current mode is the only operation mode as a special order specification in the pursuit of usability.

Uninterruptible DC power system (For radio communication equipment)

This is an equipment that maintains DC output even when failures occur in the commercial power supply. This equipment is for social infrastructures, etc., which always need a stable DC output.
(The photograph shows an example of DC13.8 V-16 A model (over 5 A-2h at power outage).)

Charge-discharge power system (For acral parts)

This is a model whose rated current has been changed as requested based on a catalog model Charge-discharge tester PFX2000. Charge-discharge test under various conditions of PFX2000 is available.
(The photograph shows an example of DC5 V-50 A 1CH model.)

We also provide sample connection jigs for quantitative and reproducible tests.

- For cylindrical or square batteries

- For polymer or laminate batteries

Test system

We provide an exclusive test system that is made only for you and includes application software required as a test system and a rack as well as the equipment. Kikusui, which is famous for its “measurement and power supply,” supports your high technology with our unique custom-made test system.

Modified products

We accept orders for the various modified products based on the products in the catalog.
Modified products that can be designed to meet specific application by adding your custom specifications to the products in our catalog, which have technology and reliability that have been built based on the standard specitications.

- Addition/change of various signal input and output functions
- Addition/change of operation system
- Change of operation rating, etc….

For information about modifying the products in the catalog, please feel free to contact us.

Harmonic/Flicker Analyzer system (LIN1020JF mounting system)

Charge-discharge test system (PFX2021 x20units mounting system)

Prearcing characteristic test system (PLZ-4W mounting system)

32kW x 3ch DC power system (PAT-T mounting system)

DC power system (PWR800L x10units mounting system)

Rack Mount

Various Kikusui products can be easily mounted in a rack by using a bracket and rack mount frame, rack adaptor, etc.

JIS standards (millimeter size) and EIA standards (inch size) racks are available. Brackets and rack mount frames, rack adaptors, etc. applicable to each type are also available.

Since the width of one panel is 50 mm for JIS Standards and 44.45 mm for EIA Standards, the bracket and rack mount frame, etc. of the panel width matched to the product body are selected based on one panel width.

Racks

The KRO Series are designed in accordance with both JIS Standards and EIA Standards. Since these racks are equipped with support angle as standard, even heavy products can be mounted. (With products weighing more than 70 kg, use a rack with brackets.)

The KRO Series conforms both JIS and EIA standards simply replacing the front panel with the rear panel.

The KRC series is a multifunctional decorative rack that is based on a steel cabinet rack and designed to allow the attachment of various rack options.

In addition to having models that meet two different standards (JIS and EIA) and being available in two overall heights (1,835 mm and 1,435 mm), this series comes in depths of 800 mm and 950 mm (two types), giving it eight models in all. Also, additional support angles (two types), base fittings and suspension eyebolts are available as separately sold options.

The Enclosed type rack (Custom Product on request)

The rack system that will be used for concerning the heat generated from the Power Supplies, considerable amount of the dust as an environmental condition, metal corrosion occurred such as at plating factory, an electrolytic chemical synthesis factory.

(*The water cooled unit will be built in the system which require for the water pipe and drain)

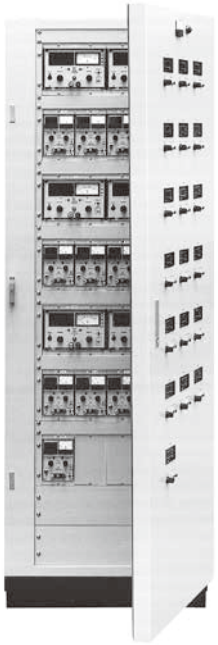
Model		Pay load weight	Number of panels		Overall height	Weight	The length for maximum surface	Support angle	Support leveler	Options		
		kg	JIS	EIA	mm	kg				Support angle	Base hold angle	Eyebolt
Open rack (KRO series)	KRO1600	Approx. 300	32	36	1825	55	700	12 (6 pairs)	4			
	KRO1250		25	28	1475	50		10 (5 pairs)				
	KRO900		18	20	1125	45		8 (4 pairs)				
Decorative rack (KRC series)	KRC363L	Approx. 300		36	1835	95	950	12 (6 pairs)	4	OP01-KRC OP02-KRC *1	OP03-KRC *2	OP04-KRC *3
	KRC273L			27	1435	85		10 (5 pairs)				
Decorative rack (KRC series) Production item upon order	KRC363	Approx. 300		36	1835	90	800	12 (6 pairs)	4			
	KRC273			27	1435	75		10 (5 pairs)				
	KRC1603		32		1835	90	800	12 (6 pairs)				
	KRC1603L					95	950					
	KRC1203		24		1435	75	800	10 (5 pairs)				
	KRC1203L					85	950					

• The KRO Series payload weight can be increased to approximately 400 kg by changing the casters.
• The KRO Series are sold in kit form.
• The support angle is designed for Kikusui racks and products. It is not interchangeable with products of the other manufacturer.
*1: These support angles (OP01-KRC) are equivalent to the support angles incorporated into the main rack unit.
They come in a two-item (1-pair) set. When the product weight exceeds 70 kg, use a weight support angle (OP02-KRC).
*2: These L-shaped fittings (OP03-KRC) secure the base of the rack to the floor. The set includes four main fitting components and the bolts and nuts that secure the fittings to the bases.
*3: These eyebolts (OP04-KRC) are specially made for the KRC series. The set includes four M12 eyebolts.

KRO Series

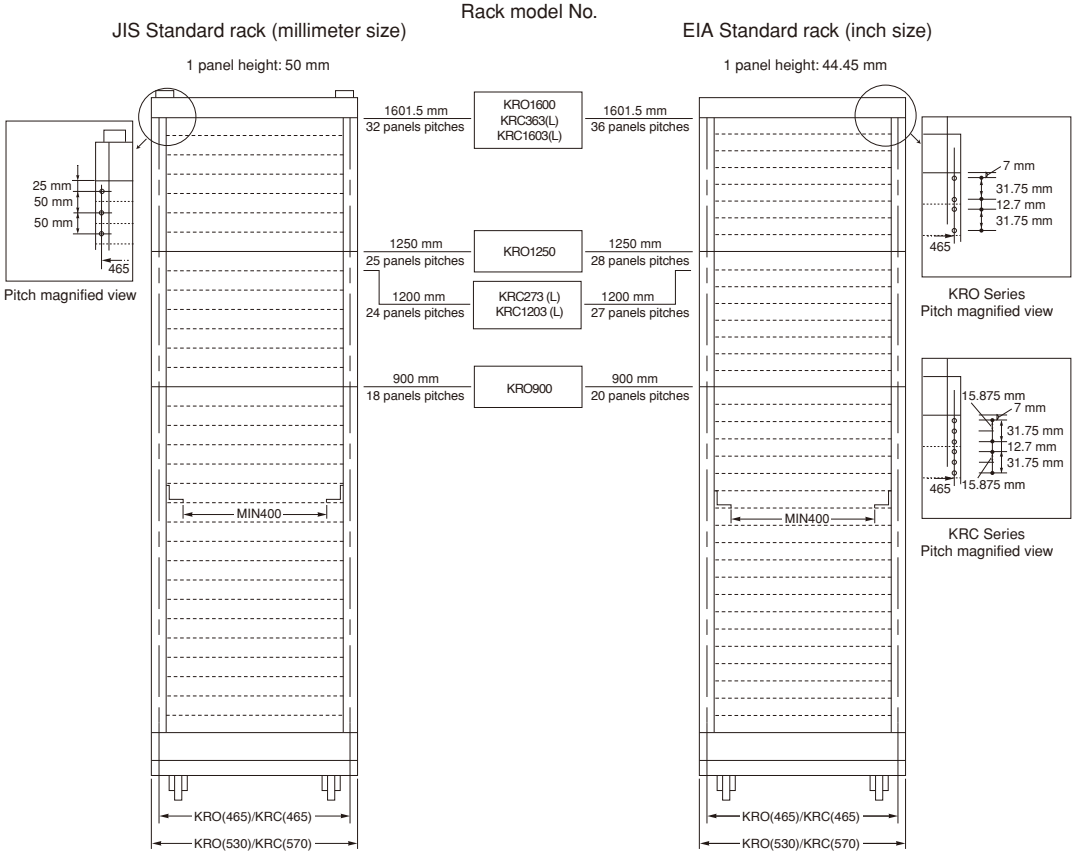
KRC Series

The Enclosed type rack



[NOTICE]
Please use supporting angles (reinforcing cramps).
When mounting product by using rack mount frame, rack adapter, and bracket, please make sure to support the mounted product by using the supporting angle (reinforcing cramps) capable of bearing the product load.

Racks Mount



Racks & Accessories

■ For use with rack mounting frame and special brackets

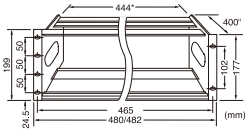
RMF4 and RMF4M are rack mount frames to be used with standard racks. Designed to meet the EIA/JIS standards, they are used to install models ranging from 1/2 rack to 1/6 rack in width using a rack mount frame bracket.

Complied products
- PAN-A Series
- PIA4810
- PIA4820

RMF-4M

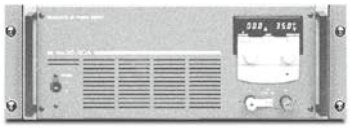
Blank panel (sold separately)

RMF-4



■ Bracket

The bracket can be used to install models of 1 (1/1) rack in width directly in the rack.



Sample for the bracket (Pair of right and left portion)
*Inch screws are not included.

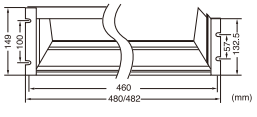
■ For use with rack adapter

KRA3 and KRA150 are rack adapters conforming to EIA/JIS standards to be used with standard racks. Power supplies can be stored without using brackets.

Complied products
- PWR-01 Series
- PWR Series (400/800 W)
- PAV Series
- PWX750ML
- PMX-A Series
- PMX-Multi Series
- PMP Series
- PCR500MA
- PLZ-4W Series (TYPE I)
- PLZ-4WL Series
- PLZ-4WH Series (TYPE I)
- PLZ-5W Series (200/400 W)
- PIA4800 Series
- PFX2500 Series

KRA150

KRA3



■ Blank panel

When using brackets to install models liable to give off heat, it is necessary to provide at least the minimum number of blank panels required for each model. Plate-type panels and mesh-type blank panels are also available.

Sample for the blank panel

EIA Standard Rack (Inch Size) Mounting Options

	Product name			Bracket		Blank panel	Rack mount frame			Rack adapter	
	Series	Type	Width	Bracket model No.	Panel width(*2)	"M" is added for mesh type	Rack mount frame model No.	Panel width(*2)	Bracket necessary when fastening mainframe to rack mount frame	Rack adaptor model No.	Panel width(*2)
DC power supply	PAD-LA	III	1	KRB5-PAD	5	BP191(-M)					
		IV	1	KRB11-PAD	11	BP191(-M)					
	PAT-T		1	KRB3-TOS	3						
	PAN-A	0	1/4			BP191(-M)	RMF4	4(*3)	B42		
		I2[I3]	1/2			BP191(-M)	RMF4	4(*3)	B22		
		II	1	BH4	4(*3)	BP191A(-M)					
	PAS	I	1/6							KRA3	3
		II	1/3							KRA3	3
		III	1/2							KRA3	3
	PAV		1/6							KRA2-PAV	2
	PWX	Half-rack size	1/2							KRA1-PWX HALF SINGLE KRA1-PWX HALF PAIR KRB1-PWX SUPPORT ANGLE (*6)	
		Full-rack size	1							KRB1-PWX SUPPORT ANGLE (*6)	
	PWR-01	400	1/6							KRA3	3
		800	1/3							KRA3	3
		1200	1/2							KRA3	3
		2000	1	KRB3-TOS	3						
	PWR	400	1/4							KRA3	3
		800	1/2							KRA3	3
		1600	1	KRB3-TOS	3						
	PBZ		1	KRB3-TOS	3						
	PMC		1/4			BP191(-M)				KRA3(*5)	3
	PMP		1/3			BP191(-M)				KRA3(*3)	3
	PMX-A		1/4			BP191(-M)				KRA3	3
	PMX-Multi		1/2			BP191(-M)				KRA3	3
AC power supply	PCR-WE/WE2	1000/2000/3000	1	KRB3-TOS	3						
		6000	1	KRB6	6						
		12000	1	KRB9	9						
	PCR-MA	500	1/2							KRA3	3
		1000	1	KRB3-TOS	3						
		2000	1	KRB3-TOS	3						
		4000	1	KRB6	6						
	PCR-LE	500	1	KRB4	4						
		1000	1	KRB6	6						
		2000	1	KRB9	9						
Electronic Load	PLZ-5W	200/400	1/2							KRA3	3
		1200	1	KRB3-TOS	3						
	PLZ2405WB		1	KRB2-TOS	2						
	PLZ-5WH	12000	1	KRB9	9						
		20000	1	KRB13	13						
	PLZ-5WH2	1000/2000/4000	1	KRB3-TOS	3						
		12000	1	KRB9	9						
		20000	1	KRB13	13						
	PLZ-4W	I	1/2							KRA3	3
		II	1	KRB3-TOS	3						
	PLZ-4WL		1/2							KRA3	3
	PLZ-4WH	I	1/2							KRA3	3
		II	1	KRB3-TOS	3						
	PLZ2004WB		1	KRB3-TOS	3						
	PLZ2004WHB		1	KRB4	4						
	PLZ-U	PLZ-30F	2/3	KRB3-PLZ-30F	3						
		PLZ-50F	1	KRB3-PLZ-50F	3						
	PLZ6000R		1	KRB4	4						
	PCZ1000A		1	KRB3	3						
Power supply controller	PIA4810/PIA4820		1/3			BP191(-M)	RMF4	4(*3)	B2-PIA4810/4820	KRA3	3
	PIA4830		1/6			BP191(-M)				KRA3	3
*1	PFX2511/PFX2512/SL01-PFX		1/2							KRA3	3
*1	PFX2532		1	KRB3-TOS	3						
*1	PFX2421/PFX2431/PFX2441		1	KRB4	4						

*1: Battery Tester
*2: EIA panel width is 44.45 mm (1 3/4 inch). The panel width does not include the rubber feet, casters, and levelers.
*3: Since there are force-aid cooling intake holes in the side or top and bottom of the mainframe, when mounting in the rack, the blank panel at least 1 panel wide must be installed.
*4: A support angle specially designed for the racks is supplied.
*5: Since those applied models were designed for the type of "Natural Cooling" unit, so it is required to have countermeasure for enough radiation of the heat when used with rack mounting system.
*6: The instrument may fall. Install the suitable support angles applying to the used rack system to support the instrument.

• When PIA4800 and PIA3200 power supply controller are rank-mounted together with the power supply, the rank mount frame and rack adaptor are necessary to be added depending on the series of the connected power supply.

JIS Standard Rack (Millimeter Size) Mounting Options

	Product name			Bracket		Blank panel	Rack mount frame			Rack adapter	
	Series	Type	Width	Bracket model No.	Panel width(*2)	"M" is added for mesh type	Rack mount frame model No.	Panel width(*2)	Bracket necessary when fastening mainframe to rack mount frame	Rack adaptor model No.	Panel width(*2)
DC power supply	PAD-LA	III	1	KRB250-PAD	5	BP1H(-M)					
		IV	1	KRB500-PAD	10	BP1H(-M)					
	PAT-T			KRB150-TOS	3						
	PAN-A	0	1/4			BP1H(-M)	RMF4M	4(*3)	B42		
		I2[I3]	1/2			BP1H(-M)	RMF4M	4(*3)	B22		
		II	1	BH4M	4(*3)	BP1H(-M)					
	PAS	I	1/6							KRA150	3
		II	1/3							KRA150	3
		III	1/2							KRA150	3
	PAV		1/6							KRA2-PAV	2
	PWX	Half-rack size	1/2							KRA1-PWX HALF SINGLE KRA1-PWX HALF PAIR KRB1-PWX SUPPORT ANGLE (*6)	
		Full-rack size	1							KRB1-PWX SUPPORT ANGLE (*6)	
	PWR-01	400	1/6							KRA150	3
		800	1/3							KRA150	3
		1200	1/2							KRA150	3
		2000	1	KRB150-TOS	3						
	PWR	400	1/4							KRA150	3
		800	1/2							KRA150	3
		1600	1	KRB150-TOS	3						
	PBZ		1	KRB150-TOS	3						
	PMC		1/4			BP1H(-M)				KRA150(*5)	3
	PMP		1/3			BP1H(-M)				KRA150(*3)	3
	PMX-A		1/4			BP1H(-M)				KRA150	3
	PMX-Multi		1/2			BP1H(-M)				KRA150	3
AC power supply	PCR-WE/WE2	1000/2000/3000	1	KRB150-TOS	3						
		6000	1	KRB300	6						
		12000	1	KRB400-PCR-LE	8						
	PCR-MA	500	1/2							KRA150	3
		1000	1	KRB150-TOS	3						
		2000	1	KRB150-TOS	3						
		4000	1	KRB300	6						
	PCR-LE	500	1	KRB200	4						
		1000	1	KRB300	6						
		2000	1	KRB400-PCR-LE	8						
Electronic Load	PLZ-5W	200/400	1/2							KRA150	3
		1200	1	KRB150-TOS	3						
	PLZ2405WB		1	KRB100-TOS	3						
	PLZ-5WH	12000	1	KRB400-PCR-LE	8						
		20000	1	KRB600	13						
	PLZ-5WH2	1000/2000/4000	1	KRB150-TOS	3						
		12000	1	KRB400-PCR-LE	8						
		20000	1	KRB600	13						
	PLZ-4W	I	1/2							KRA150	3
		II	1	KRB150-TOS	3						
	PLZ-4WL		1/2							KRA150	3
	PLZ-4WH	I	1/2							KRA150	3
		II	1	KRB150-TOS	3						
	PLZ2004WB		1	KRB150-TOS	3						
	PLZ2004WHB		1	KRB200	4						
	PLZ-U	PLZ-30F	2/3	KRB150-PLZ-30F	3						
		PLZ-50F	1	KRB150-PLZ-50F	3						
	PLZ6000R		1	KRB200	4						
	PCZ1000A		1	KRB150	3						
Power supply controller	PIA4810/PIA4820		1/3			BP1H(-M)	RMF4M	4(*3)	B2-PIA4810/4820	KRA150	3
	PIA4830		1/6			BP1H(-M)				KRA150	3
*1	PFX2511/PFX2512/SL01-PFX		1/2							KRA150	3
*1	PFX2532		1	KRB150-TOS	3						
*1	PFX2421/PFX2431/PFX2441		1	KRB200	4						

*1: Battery Tester
*2: JIS panel width is 50 mm. The panel width does not include the rubber feet, casters, and levelers.
*3: Since there are forced-air cooling holes in the side or top and bottom of the mainframe, when mounting in the rack, the blank panel at least 1 panel width must be installed.
*4: A support angle specially designed for the racks is supplied.
*5: Since those applied models were designed for the type of "Natural Cooling" unit, so it is required to have countermeasure for enough radiation of the heat when used with rack mounting system.
*6: The instrument may fall. Install the suitable support angles applying to the used rack system to support the instrument.

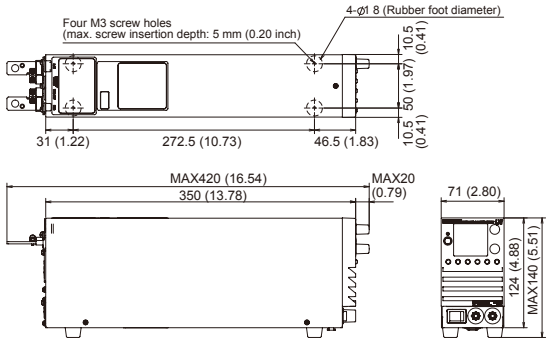
• When PIA4800 and PIA3200 Power Supply Controller are rack-mounted together with the power supply, the rack mount frame and rack adaptor are necessary to be added depends on the series of the connected power supply.

PWR-01 Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

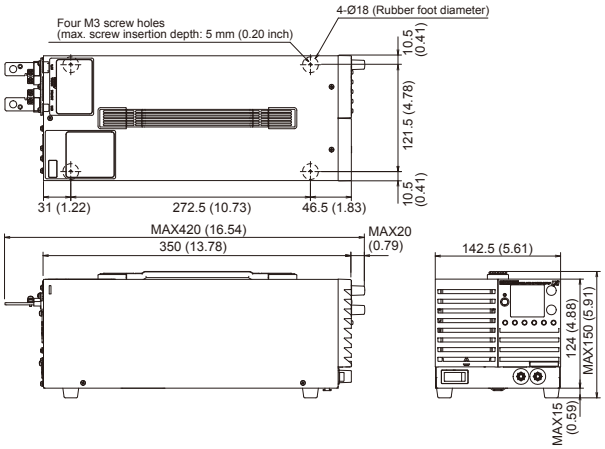
■ 400 W Model (6 units can be rack mounted)

PWR401L/PWR401ML/PWR401MH/PWR401H



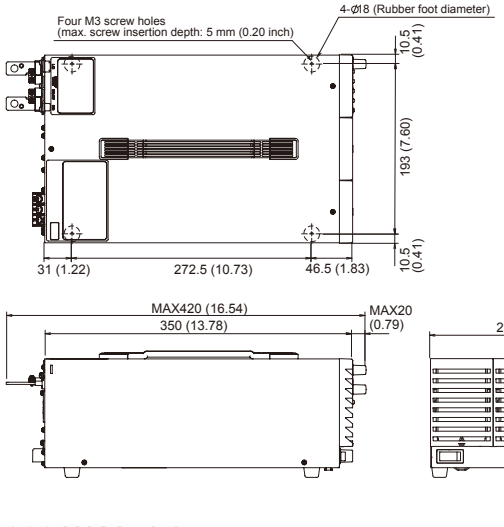
■ 800 W Model (3 units can be rack mounted)

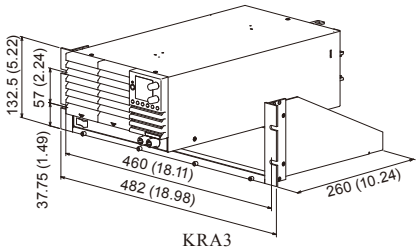
PWR801L/PWR801ML/PWR801MH/PWR801H



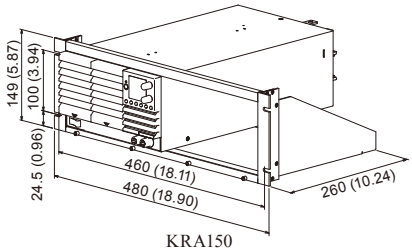
■ 1200 W Model (2 units can be rack mounted)

PWR1201L/PWR1201ML/PWR1201MH/PWR1201H





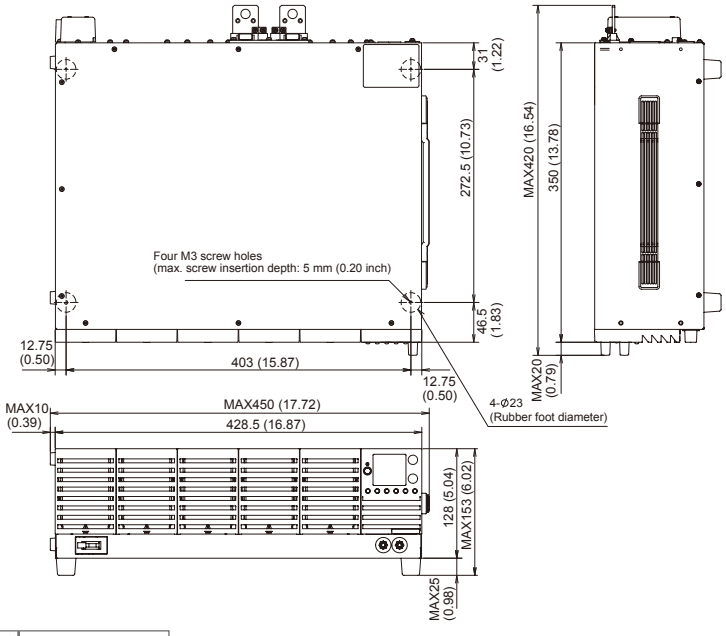
KRA3

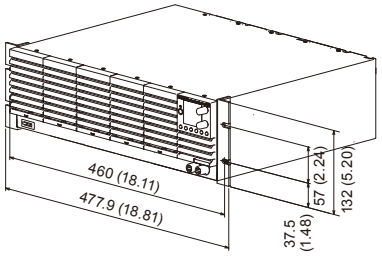


KRA150

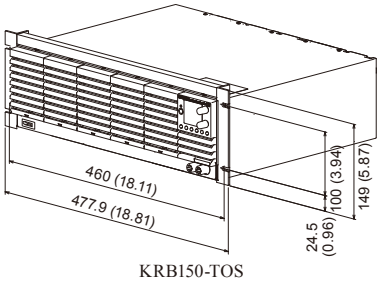
■ 2000 W Model

PWR2001L/PWR2001ML/PWR2001MH/PWR2001H





KRB3-TOS



KRB150-TOS

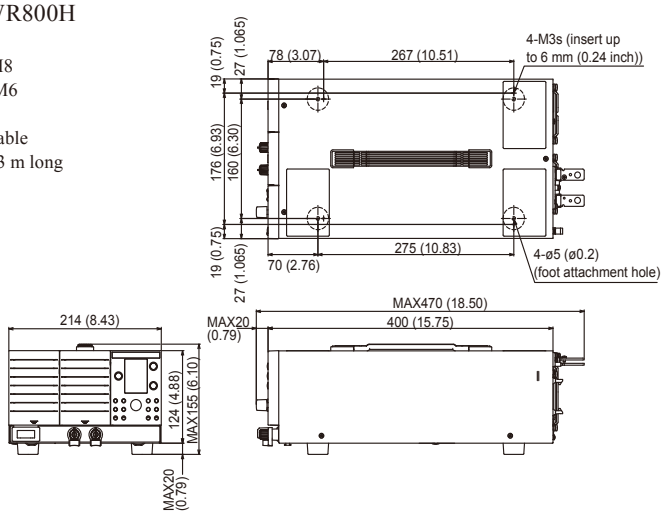
PWR Series External Dimensional Diagrams/Rack Mount Option

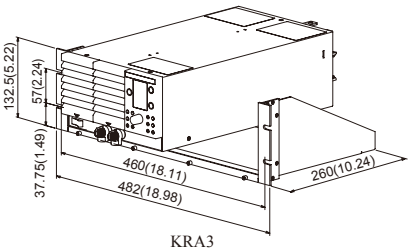
Unit: mm (inch)

■ 800 W TYPE (2 units can be rack mounted)

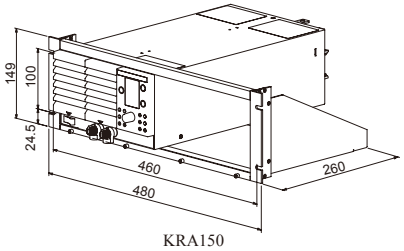
PWR800M/PWR800H

Output (Rear) M8
(Front) M6
Input AC inlet
Accessory power cable
approx. 3 m long





KRA3

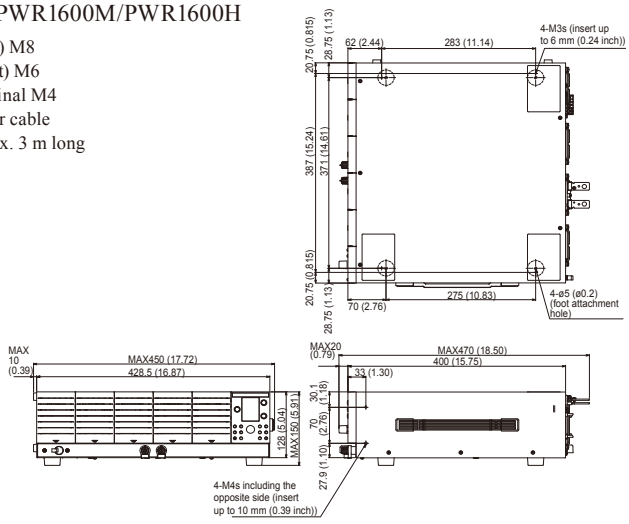


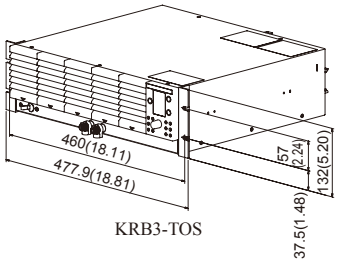
KRA150

■ 1600 W TYPE

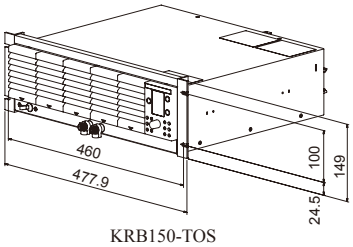
PWR1600L/PWR1600M/PWR1600H

Output (Rear) M8
(Front) M6
Input Terminal M4
Accessory power cable
approx. 3 m long





KRB3-TOS

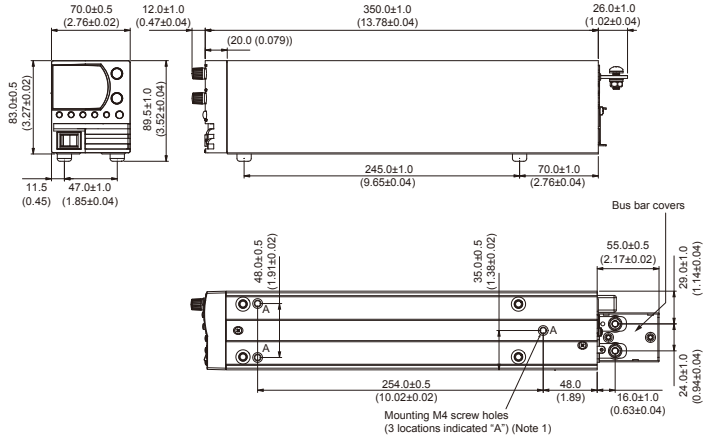


KRB150-TOS

PAV Series External Dimensional Diagrams

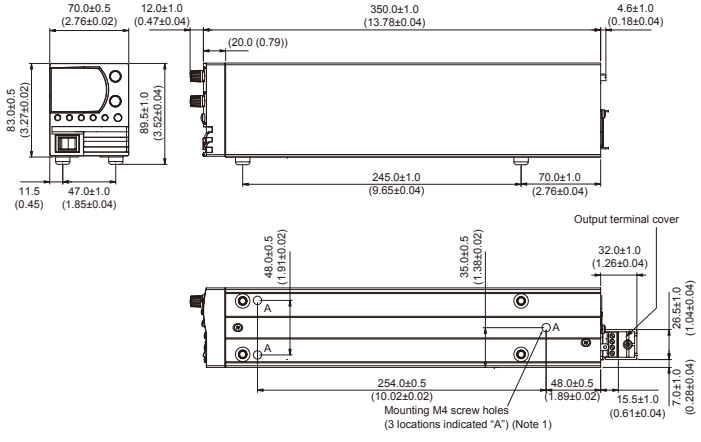
Unit: mm (inch)

■ Models whose rated output voltage is 10 V to 100 V



(Note 1) Keep screw insertion depth to 6 mm or less.

■ Models whose rated output voltage is 160 V to 650 V



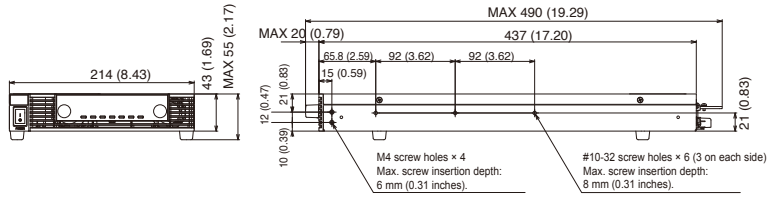
(Note 1) Keep screw insertion depth to 6 mm or less.

PWX Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

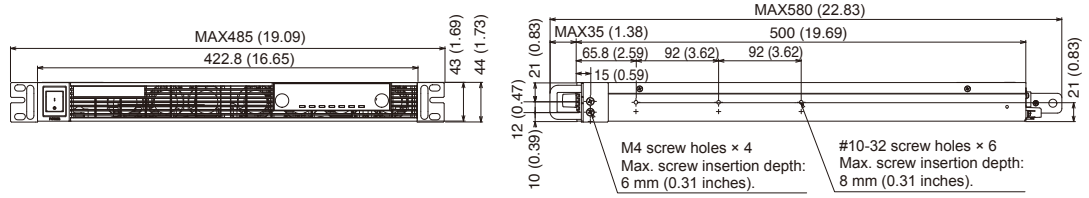
■ TYPE I

PWX750ML



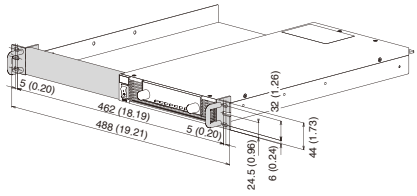
■ TYPE II

PWX750LF/PWX750MLF/PWX750MHF/PWX750HF
PWX1500L/PWX1500ML/PWX1500MH/PWX1500H

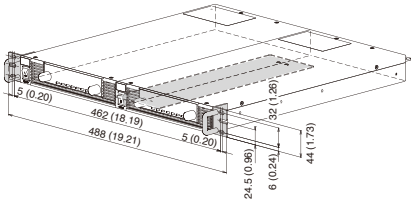


(for Type I (1U half))

●Rack mount adaptor
KRA1-PWX HALF SINGLE

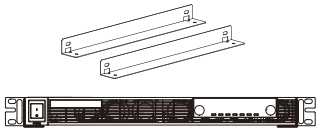


●Rack mount adaptor
KRA1-PWX HALF PAIR



(for Type I / Type II)

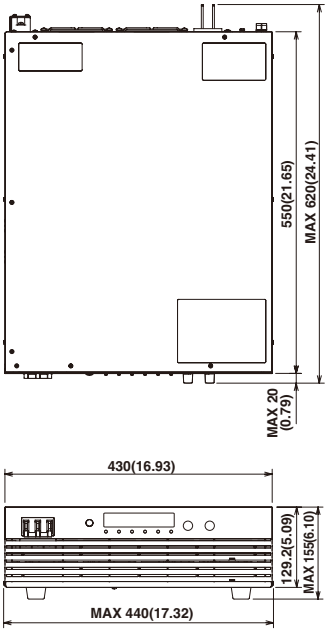
●Thin support angle
KRB1-PWX SUPPORT ANGLE



*Under the parallel operation, the optional parallel operation cable can not be used when the unit is installed side by side in the rack mount system.

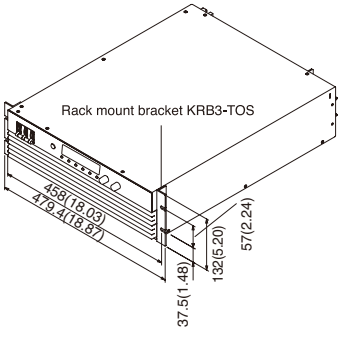
PAT-T Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)



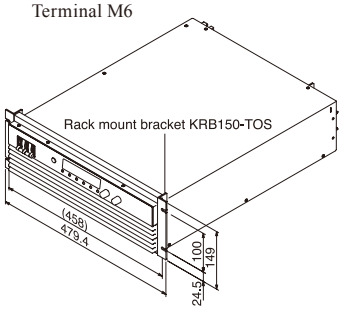
■ 4 kW

Output	PAT20-200T : M10
	PAT40-100T : M10
	PAT60-67T : M10
	PAT160-25T : M10
Input	Terminal M6



■ 8 kW

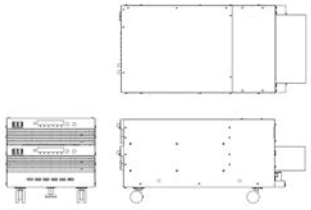
Output	PAT20-400T : M12
	PAT30-266T : M12
	PAT40-200T : M10
	PAT60-133T : M10
	PAT80-100T : M10
	PAT160-50T : M10
	PAT250-32T : M8
	PAT350-22.8T : M8
	PAT500-16T : M8
	PAT650-12.3T : M8
	PAT850-9.4T : M8
Input	Terminal M6



PAT-T Series Large Capacity Model External Dimensional Diagrams/Weight

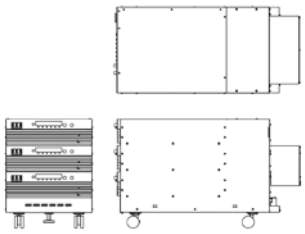
■ PAT-TM Series 16 kW System

433 (17.05") (445 (17.52")) W × 337 (13.27") (425 (16.73")) H × 765 (30.12") (945 (37.20")) D mm (inch)/
Approx.80 (176.3) kg (lbs) (Model without breaker)



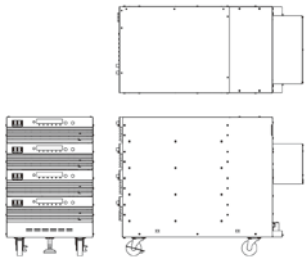
■ PAT-TM Series 24 kW System

433 (17.05") (445 (17.52")) W × 470 (18.50") (555 (21.85")) H × 765 (30.12") (945 (37.20")) D mm (inch)/
Approx.120(264.5) kg (lbs) (Model without breaker)



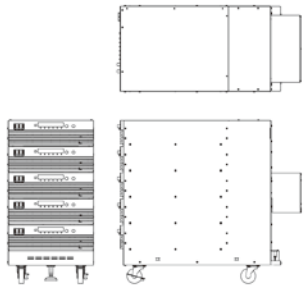
■ PAT-TM Series 32 kW System

433 (17.05") (445 (17.52")) W × 602 (23.70") (705 (27.76")) H × 765 (30.12") (945 (37.20")) D mm (inch)/
Approx.150 (330.7) kg (lbs) (Model without breaker)



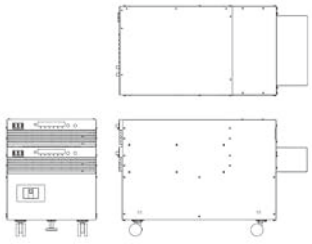
■ PAT-TM Series 40 kW System

433 (17.05") (445 (17.52")) W × 735 (28.94") (835 (32.87")) H × 765 (30.12") (945 (37.20")) D mm (inch)/
Approx.180 (396.8) kg (lbs) (Model without breaker)



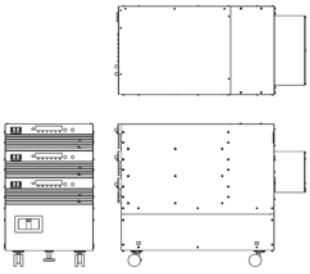
■ PAT-TMX Series 16 kW System

433 (17.05") (445 (17.52")) W × 487 (19.17") (575 (22.64")) H × 765 (30.12") (945 (37.20")) D mm (inch)/
Approx.90 (198.4) kg (lbs) (Model with breaker)



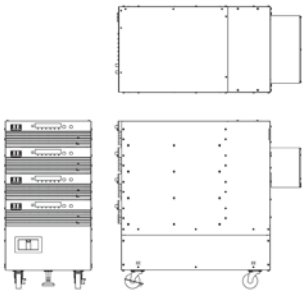
■ PAT-TMX Series 24 kW System

433 (17.05") (445 (17.52")) W × 620 (24.41") (705 (27.76")) H × 765 (30.12") (945 (37.20")) D mm (inch)/
Approx.130 (286.6) kg (lbs) (Model with breaker)



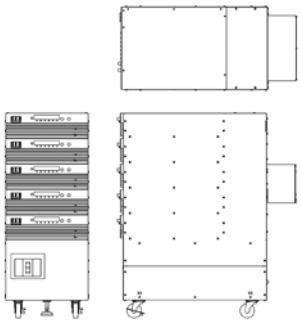
■ PAT-TMX Series 32 kW System

433 (17.05") (445 (17.52")) W × 752 (29.61") (855 (33.66")) H × 765 (30.12") (945 (37.20")) D mm (inch)/
Approx.160 (352.7) kg (lbs) (Model with breaker)



■ PAT-TMX Series 40 kW System

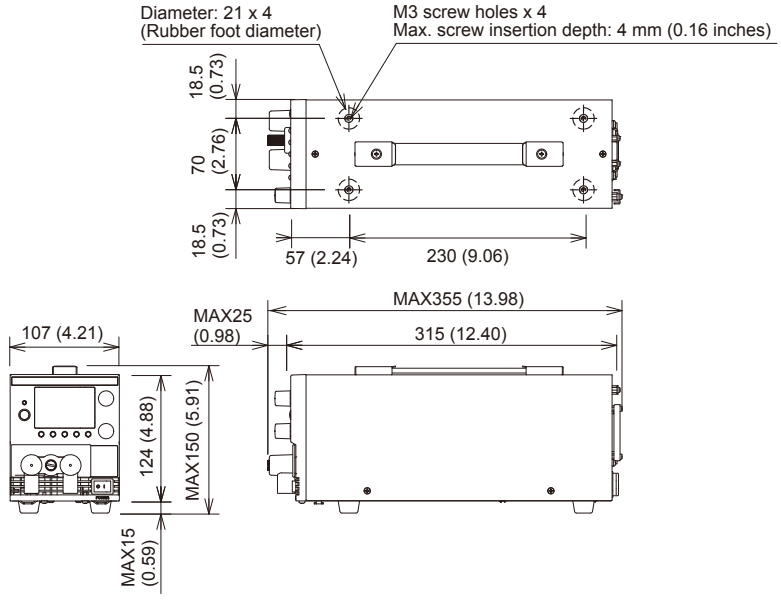
433 (17.05") (445 (17.52")) W × 975 (38.39") (1075 (42.32")) H × 765 (30.12") (945 (37.20")) D mm (inch)/
Approx.200 (440.9) kg (lbs) (Model with breaker)

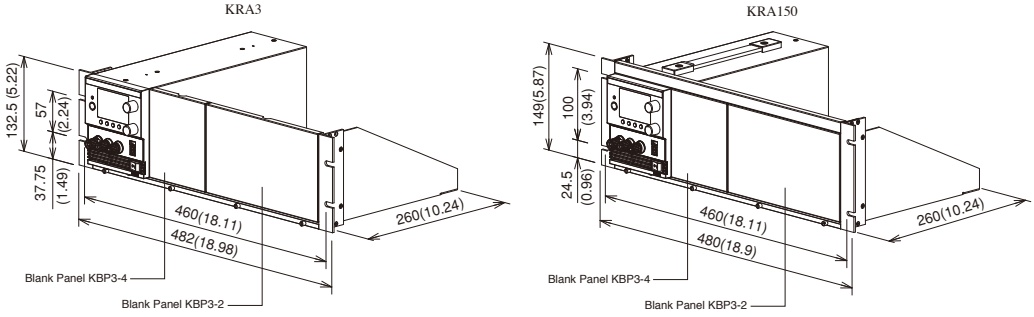


PMX-A Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

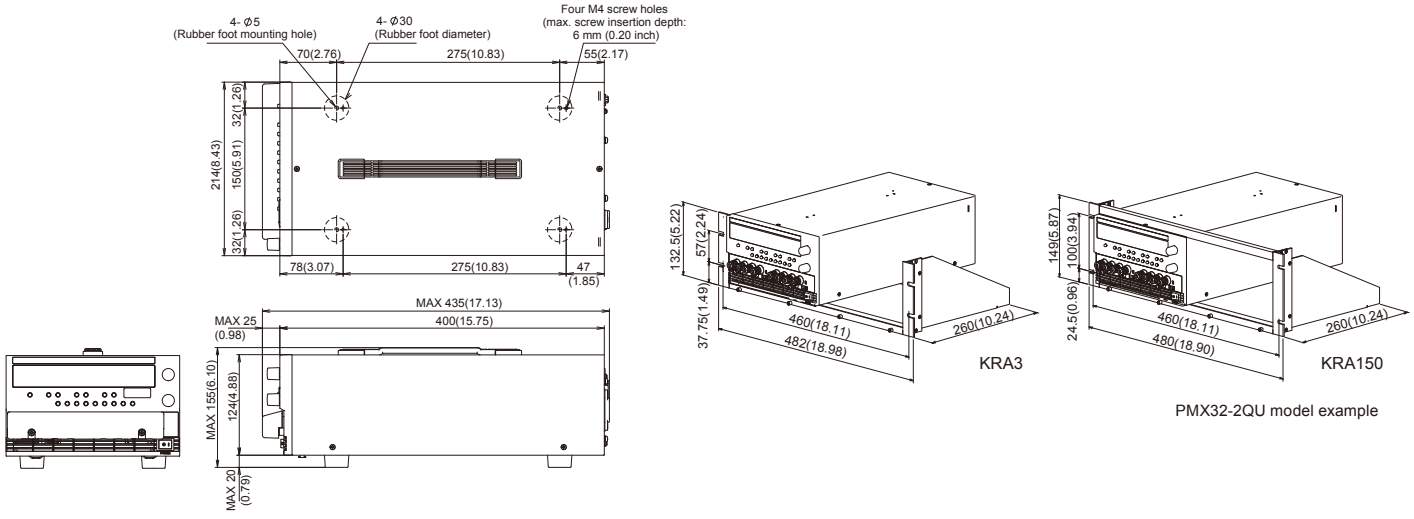
PMX18-2A/PMX18-5A
PMX35-1A/PMX35-3A
PMX70-1A/PMX110-0.6A
PMX250-0.25A/PMX350-0.2A
PMX500-0.1A





PMX-Multi Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)



PMX32-2QU model example

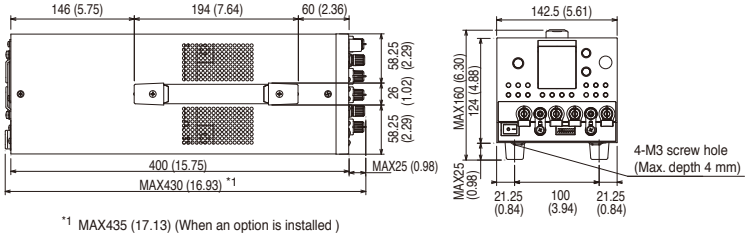
PMP Series External Dimensional Diagrams/Rack Mount Option

(3 units can be rack mounted)

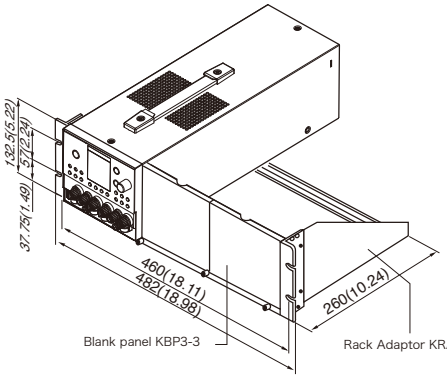
Unit: mm (inch)

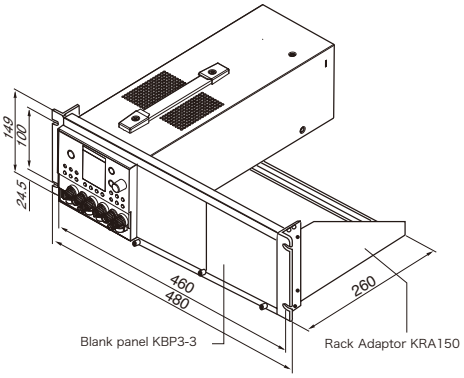
PMP18-3TR
PMP25-2TR
PMP16-1QU

Output (Front) Binding post M6
Input AC inlet
Accessory power cable
approx. 2.5 m long



*1 MAX435 (17.13) (When an option is installed)



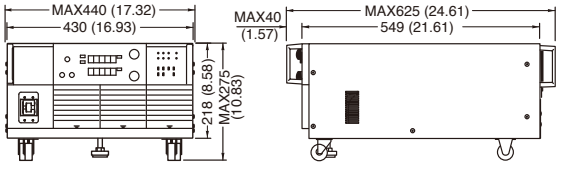


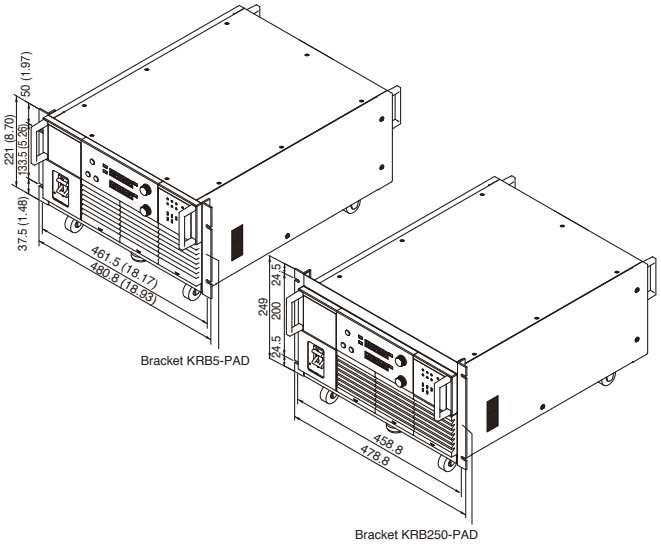
PAD-LA Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

■ TYPE III

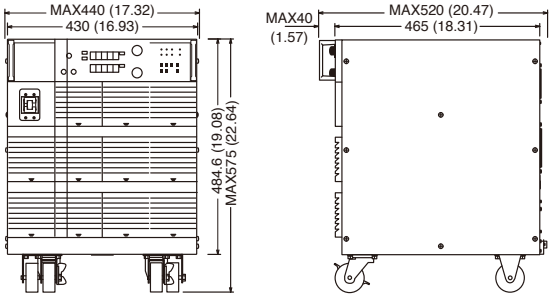
PAD16-100LA/PAD36-60LA
PAD60-35LA/PAD72-30LA
PAD110-20LA/PAD250-8LA

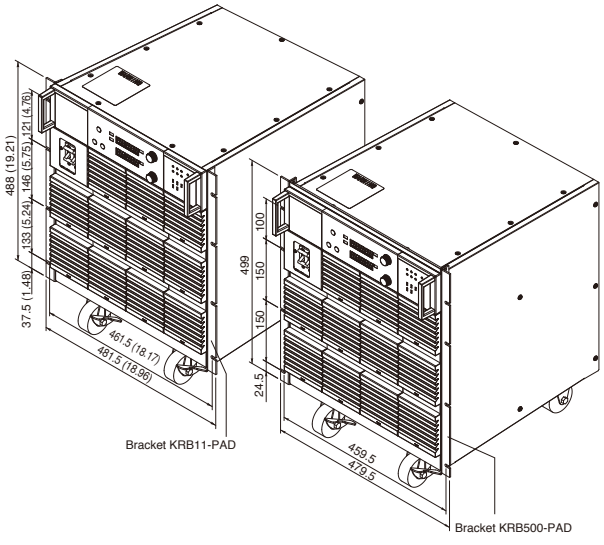




■ TYPE IV

PAD36-100LA/PAD60-60LA
PAD110-32LA/PAD250-15LA



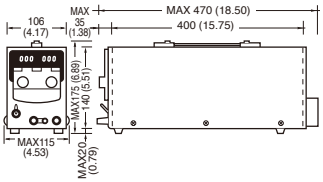


PAN-A Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

■ 175 W TYPE (TYPE 0)
(4 units can be rack mounted)

PAN16-10A/PAN35-5A
PAN60-3A/PAN70-2.5A
PAN110-1.5A/PAN160-1A

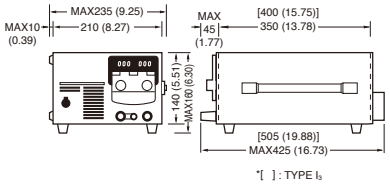


Output (Rear) Terminal M4
(Front) Binding post M6
(auxiliary output terminal)
Input AC inlet
Attached power cable
SVT3 × 18AWG, approx. 3 m long,
with 3P plug

■ 350 W TYPE (TYPE I_2)/ 700 W TYPE (TYPE I_3)
(2 units can be rack mounted)

■ 350W TYPE
PAN16-18A/PAN35-10A
PAN60-6A/PAN70-5A
PAN110-3A/PAN160-2A

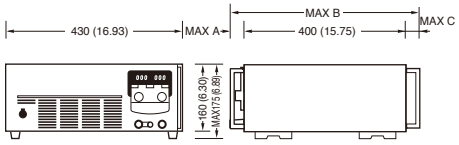
■ 700W TYPE
PAN16-30A/PAN35-20A
PAN60-10A/PAN70-8A
PAN110-5A/PAN160-3.5A
PAN250-2.5A



Output (Rear) Terminal M4
(Front) Binding post M8
(auxiliary output terminal)
Input 350 W Type: AC inlet
700 W Type: Terminal M4
Attached power cable
350 W Type: SVT3 × 18AWG, approx. 3 m long,
with 3P plug
700 W Type: Nominal sectional area 2.0 SQ. mm,
cabtyre cable, with 3P plug, approx. 3 m long(For PAN35-20A: Norminal sectional area 3.5 SQ. mm,cabtyre cable, approx. 3 m long)

■ 1000 W TYPE (TYPE II)

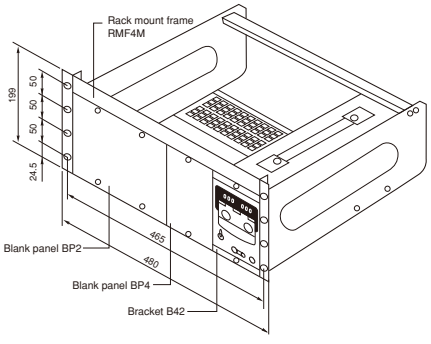
PAN16-50A/PAN35-30A
PAN60-20A/PAN70-15A
PAN110-10A/PAN160-7A
PAN250-4.5A/PAN350-3.5A
PAN600-2A

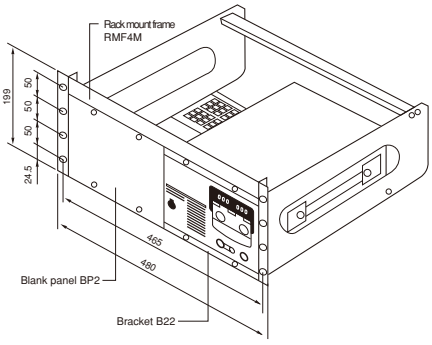


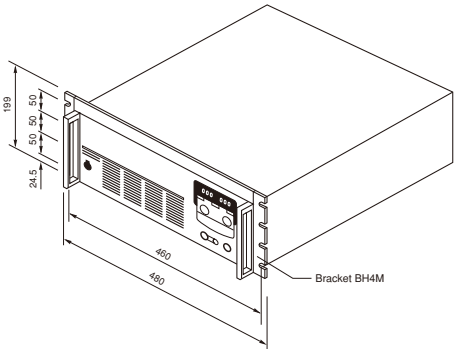
MODEL	MAX A	MAX B	MAX C
PAN16-50A	40 (1.57)	500 (19.69)	60 (2.36)
PAN35-30A PAN60-20A PAN70-15A PAN110-10A PAN160-7A PAN250-4.5A PAN350-3.5A PAN600-2A	45 (1.77)	505 (19.88)	60 (2.36)

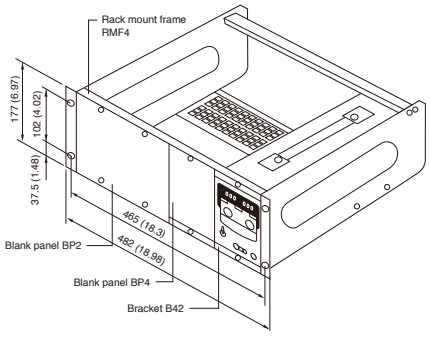
Output (Rear) Terminal M4 (M5 for PAN16-50A)
(Front) Binding post M8
(auxiliary output terminal)
Input Terminal M4
Attached power cable
Nominal sectional area 3.5 SQ. mm,
cabtyre cable, without plug, approx. 3 m long)

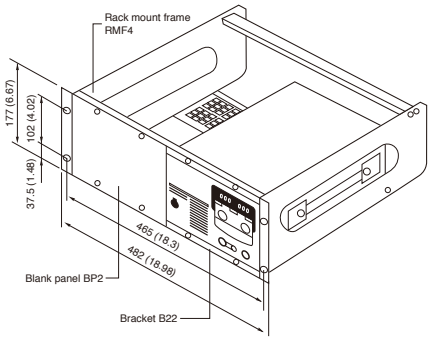
Note: There is no auxiliary output terminal, on the front panel of Model PAN16-50A.

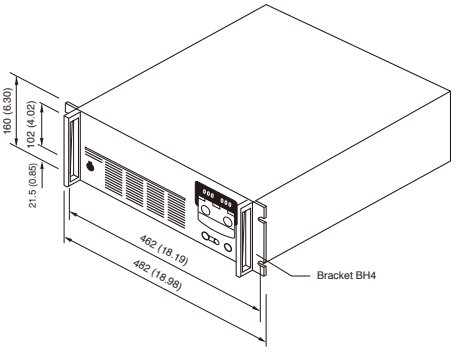








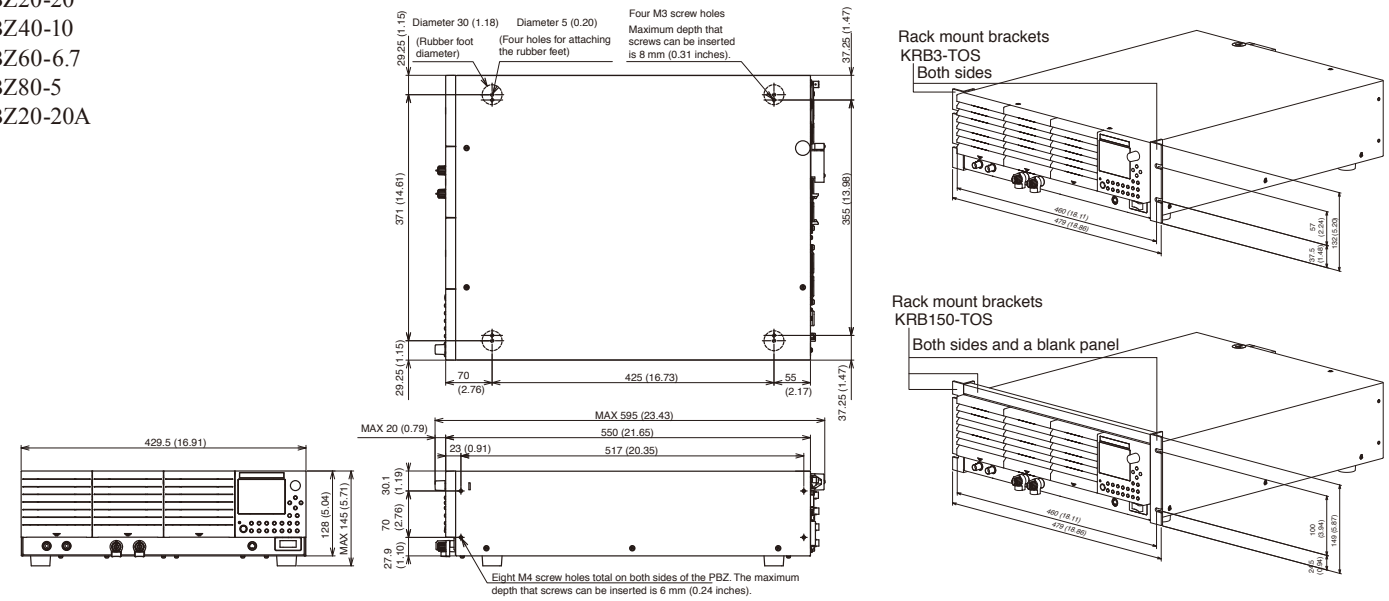




PBZ Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

PBZ20-20
PBZ40-10
PBZ60-6.7
PBZ80-5
PBZ20-20A



PBZ SR Series External Dimensionals

■ Dimensions (mm (inch) (Maximum dimensions))

PBZ20-60 SR	432.6 (17.03") (545 (21.46")) W × 579.4 (22.81") (685 (26.97")) H × 700 (27.56") (735 (28.94")) D
PBZ40-30 SR	
PBZ20-80 SR	432.6 (17.03") (545 (21.46")) W × 712.1 (28.04") (815 (32.09")) H × 700 (27.56") (735 (28.94")) D
PBZ40-40 SR	
PBZ20-100 SR	432.6 (17.03") (545 (21.46")) W × 844.8 (33.26") (950 (37.40")) H × 700 (27.56") (735 (28.94")) D
PBZ40-50 SR	

PBZ BP Series External Dimensionals

■ Dimensions (mm (inch))

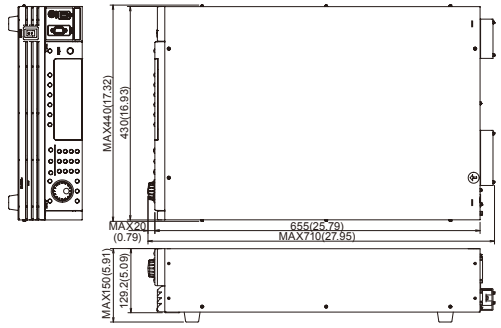
PBZ20-120 BP	570(22.44") W × 1350(53.15") H × 950(37.40") Dmm
PBZ40-60 BP	
PBZ20-140 BP	570(22.44") W × 1350(53.15") H × 950(37.40") Dmm
PBZ40-70 BP	
PBZ20-160 BP	570(22.44") W × 1350(53.15") H × 950(37.40") Dmm
PBZ40-80 BP	

PBZ20-180 BP	570(22.44") W × 1750(68.90") H × 950(37.40") Dmm
PBZ40-90 BP	
PBZ20-200 BP	570(22.44") W × 1750(68.90") H × 950(37.40") Dmm
PBZ40-100 BP	

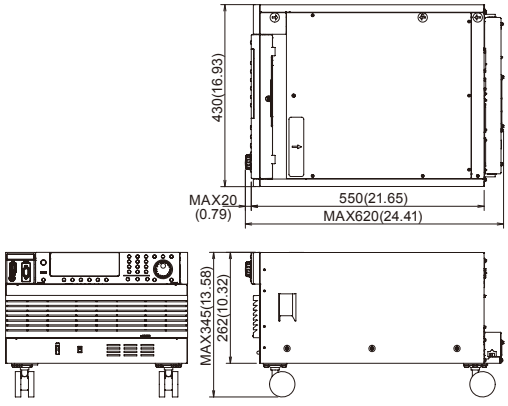
PCR-WE/WE2 Series External Dimensional Diagrams

Unit: mm (inch)

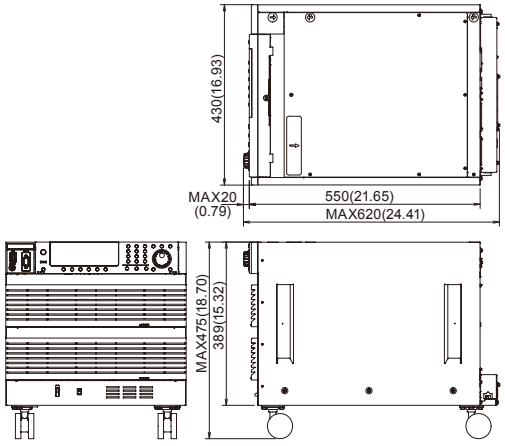
■ PCR1000WE/PCR2000WE/PCR3000WE2



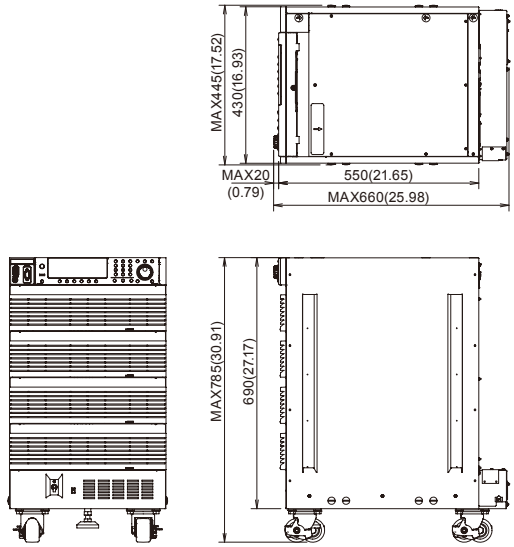
■ PCR6000WE2



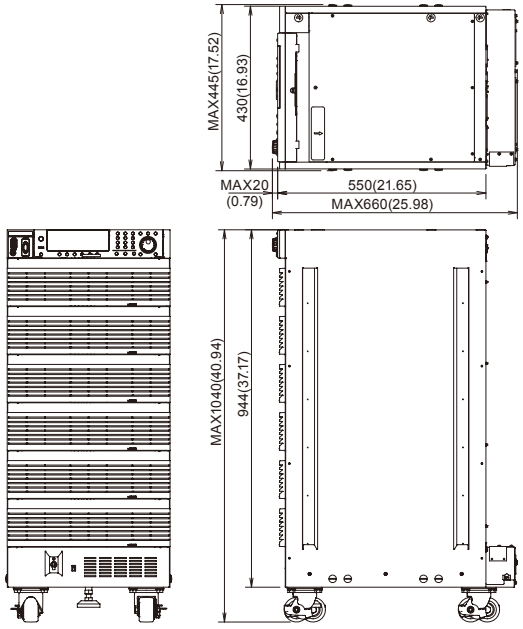
■ PCR12000WE2



■ PCR18000WE2/PCR24000WE2

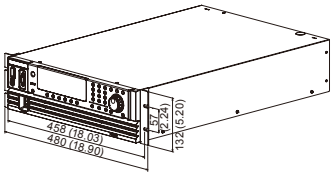


■ PCR30000WE2/PCR36000WE2

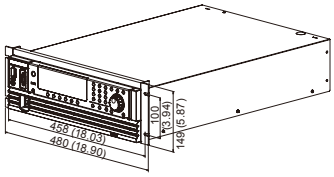


●PCR1000WE/ PCR2000WE/ PCR3000WE2

When mounting on an inch rack
(bracket model KRB3-TOS)

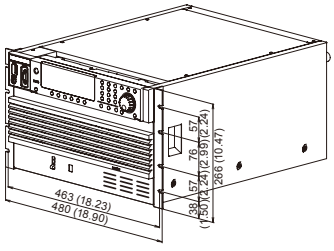


When mounting on a millimeter rack
(bracket model KRB150-TOS)

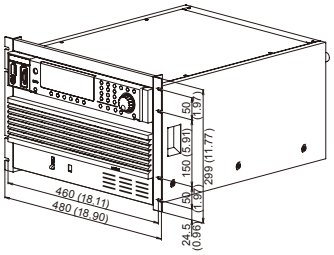


●PCR6000WE2

When mounting on an inch rack
(bracket model KRB6)



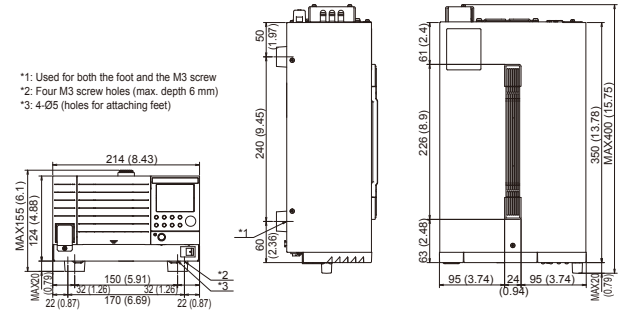
When mounting on a millimeter rack
(bracket model KRB300)



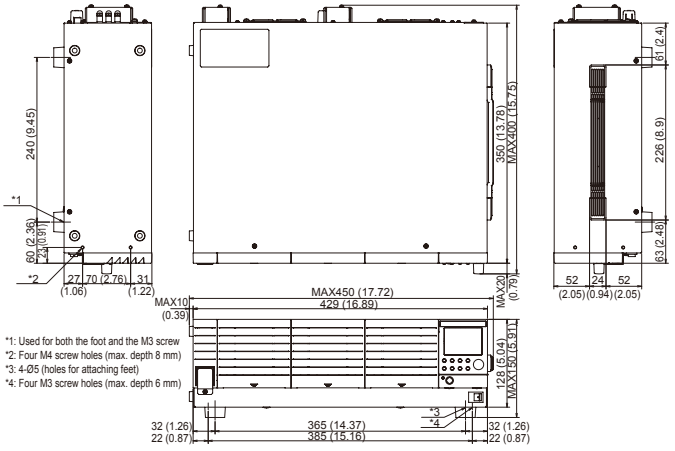
PCR-MA Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

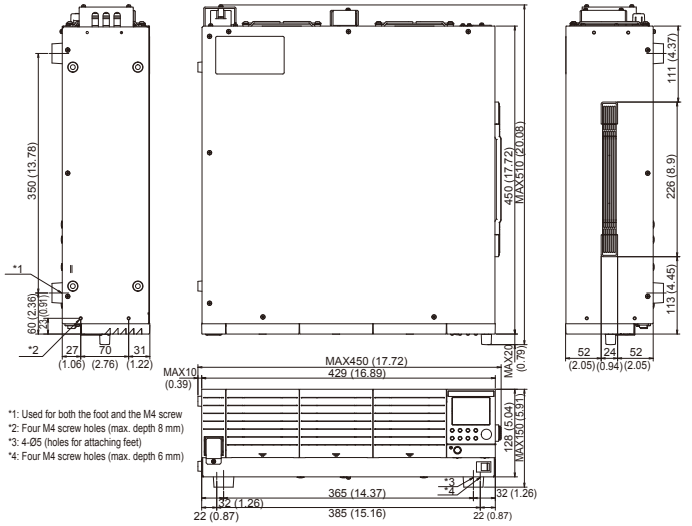
■ PCR500MA



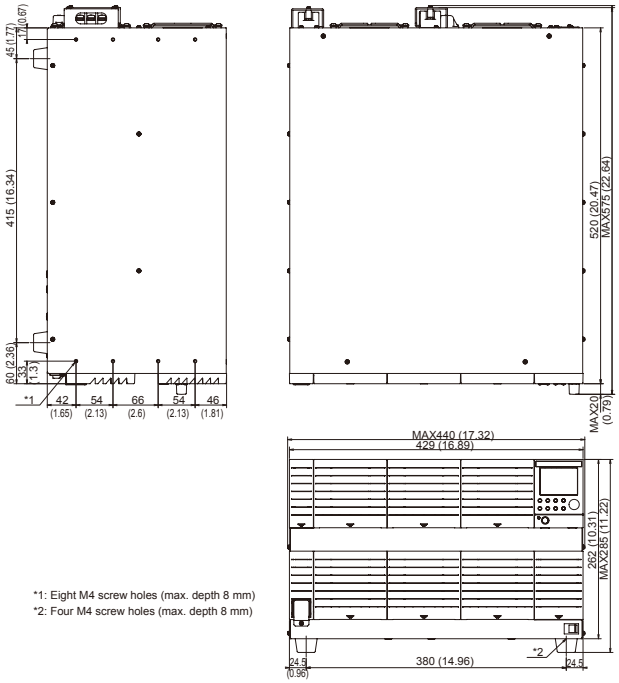
■ PCR1000MA



■ PCR2000MA

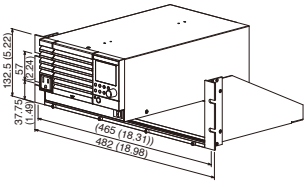


■ PCR4000MA

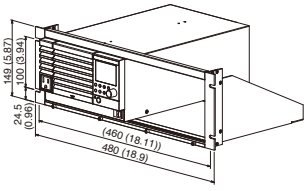


●PCR500MA

When mounting on an inch rack
(Bracket model: KRA3)

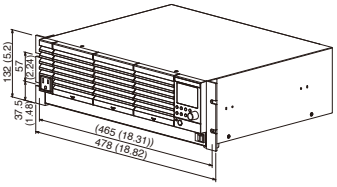


When mounting on a millimeter rack
(Bracket model: KRA150)

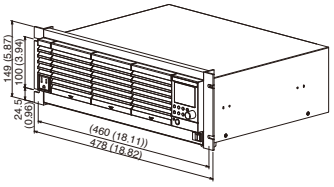


●PCR1000MA/PCR2000MA

When mounting on an inch rack
(Bracket model: KRB3-TOS)

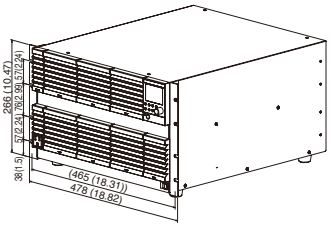


When mounting on a millimeter rack
(Bracket model: KRB150-TOS)

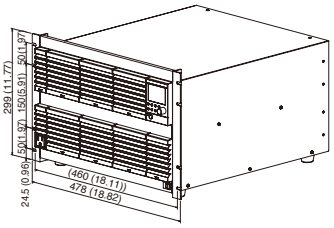


●PCR4000MA

When mounting on an inch rack
(Bracket model: KRB6)



When mounting on a millimeter rack
(Bracket model: KRB300)



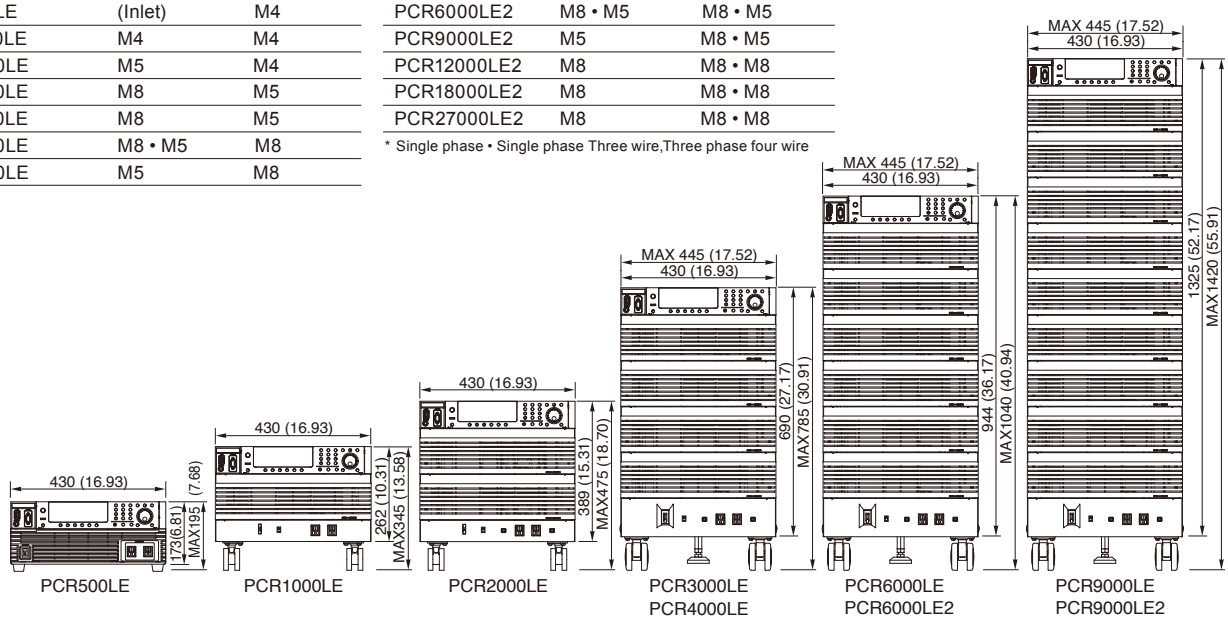
PCR-LE/LE2 Series External Dimensional Diagrams/Rack Mount Option

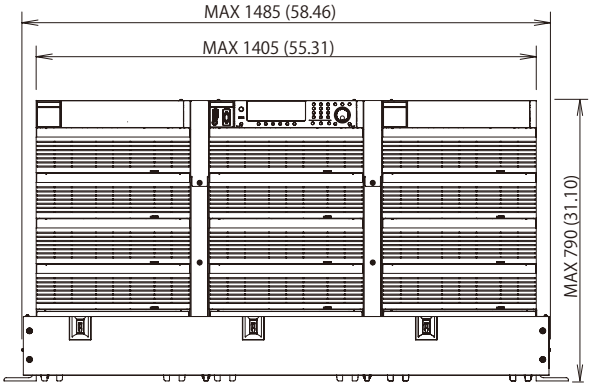
Unit: mm (inch)

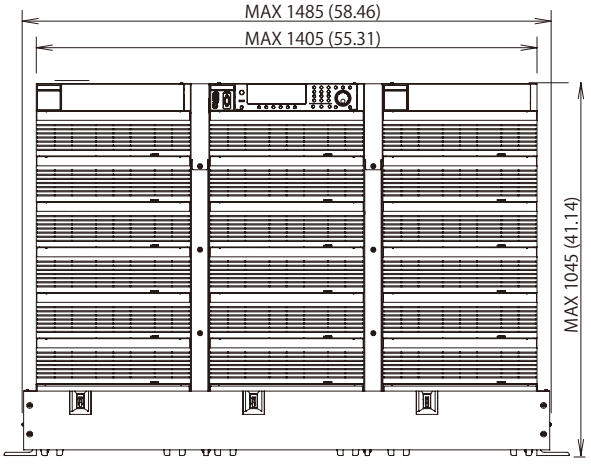
Model	Input terminal	Output terminal
PCR500LE	(Inlet)	M4
PCR1000LE	M4	M4
PCR2000LE	M5	M4
PCR3000LE	M8	M5
PCR4000LE	M8	M5
PCR6000LE	M8 • M5	M8
PCR9000LE	M5	M8

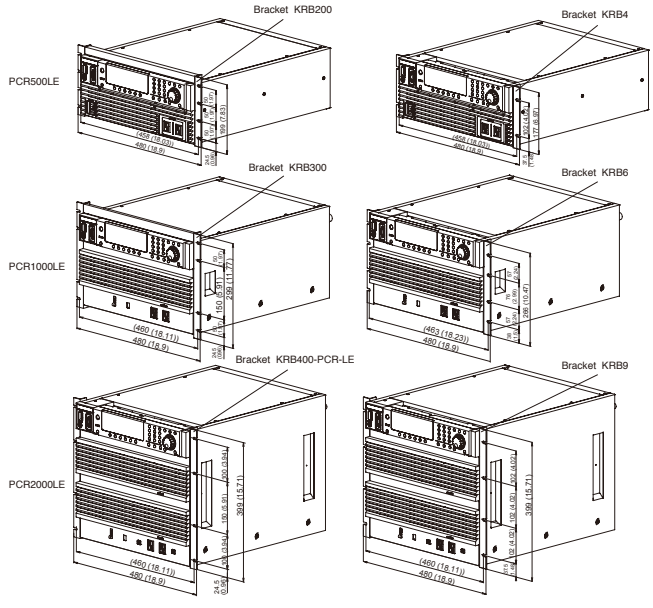
Model	Input terminal	Output terminal *
PCR6000LE2	M8 • M5	M8 • M5
PCR9000LE2	M5	M8 • M5
PCR12000LE2	M8	M8 • M8
PCR18000LE2	M8	M8 • M8
PCR27000LE2	M8	M8 • M8

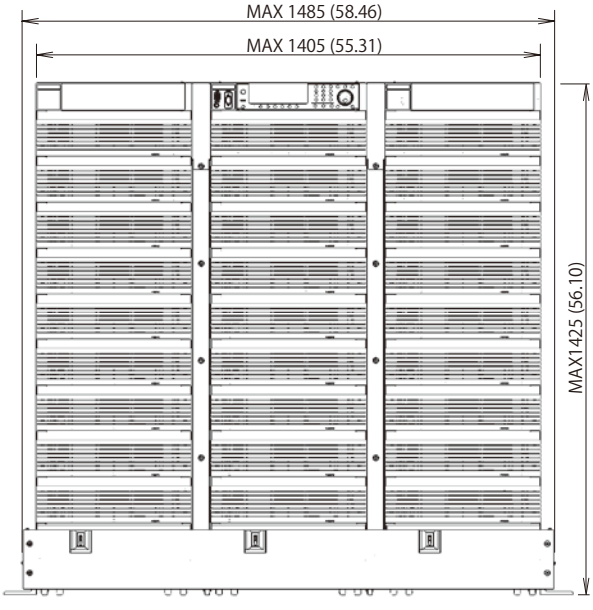
* Single phase • Single phase Three wire,Three phase four wire







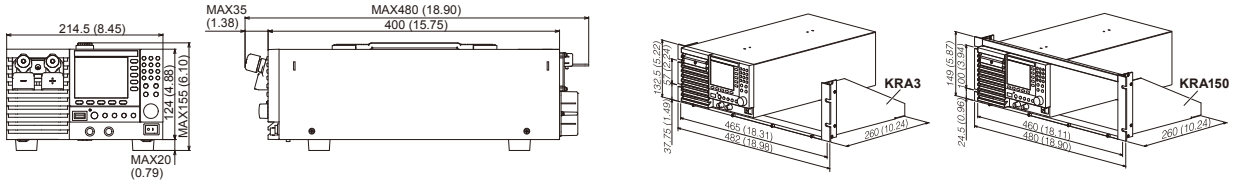




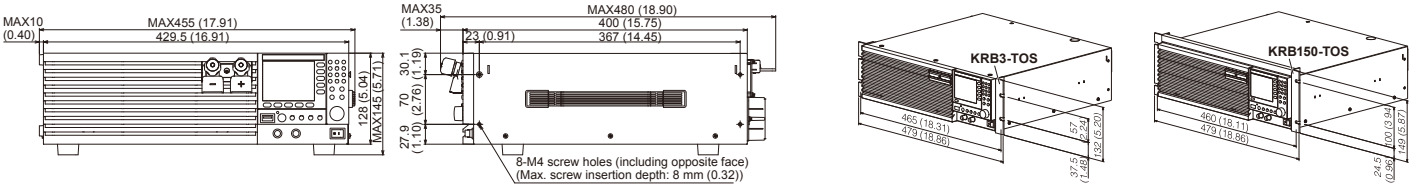
PLZ-5W Series External Dimensional Diagrams/Rack Mount Option

Unit:mm (inch)

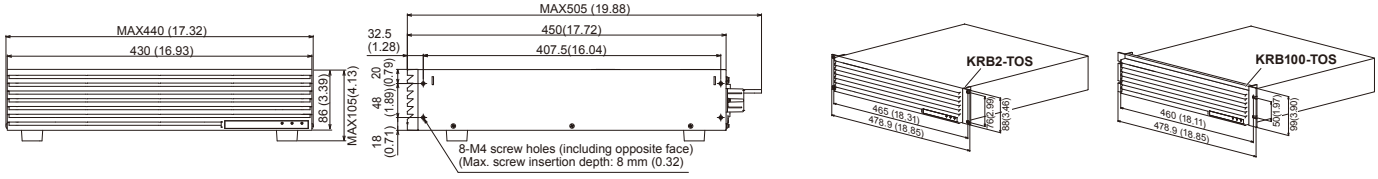
■ PLZ205W/PLZ405W



■ PLZ1205W



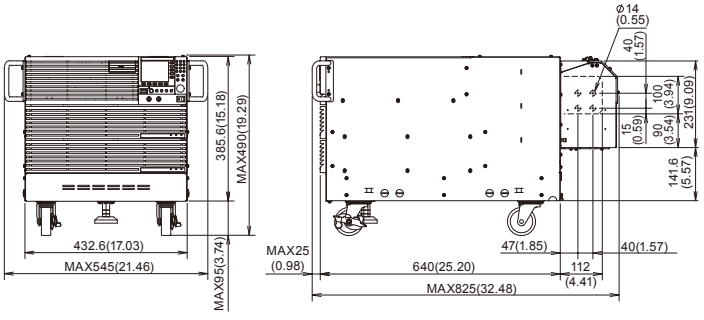
■ PLZ2405WB



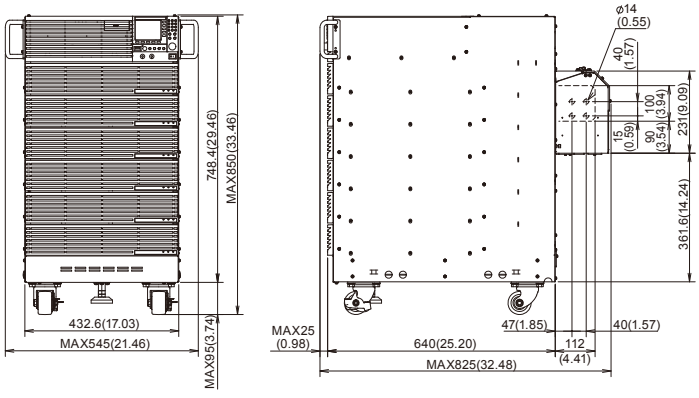
PLZ-5W SR Series External Dimensional Diagrams

Unit:mm (inch)

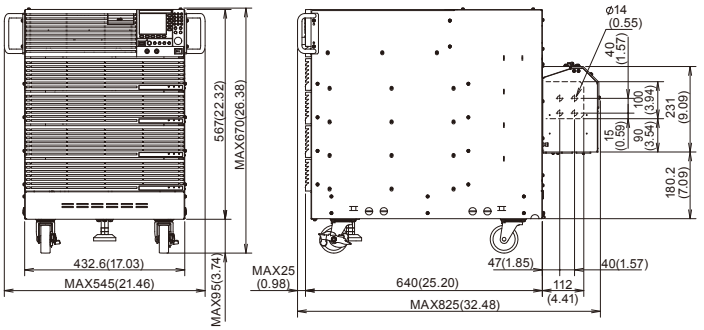
■ PLZ6005W SR



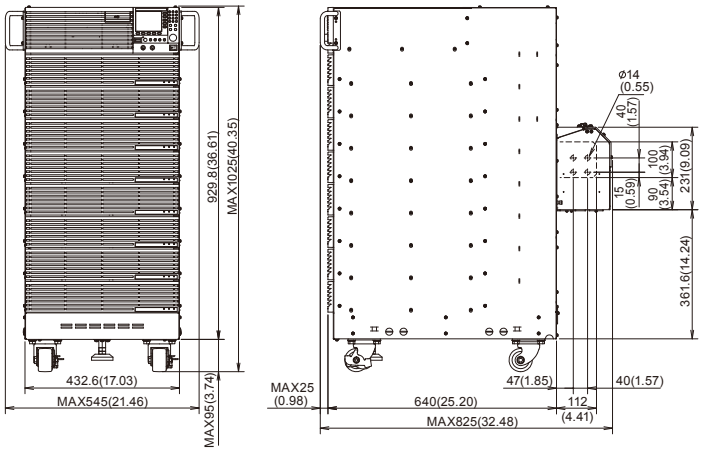
■ PLZ15005W SR



■ PLZ10005W SR



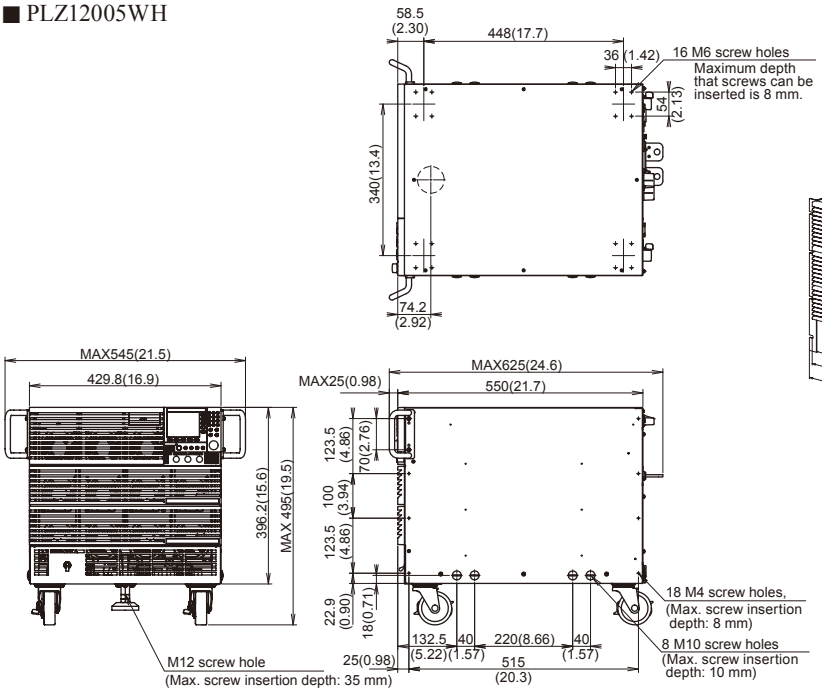
■ PLZ20005W SR

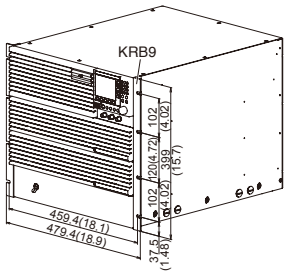


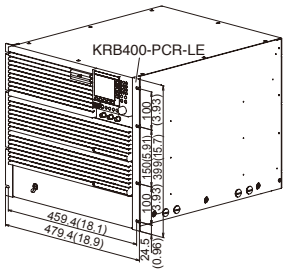
PLZ-5WH Series External Dimensional Diagrams/Rack Mount Option

Unit:mm (inch)

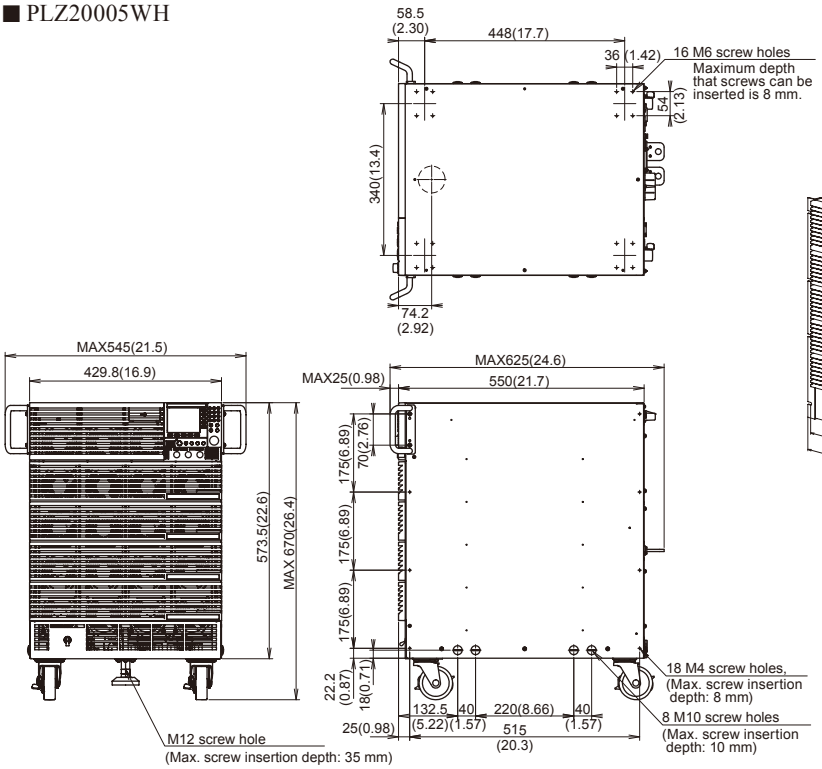
■ PLZ12005WH

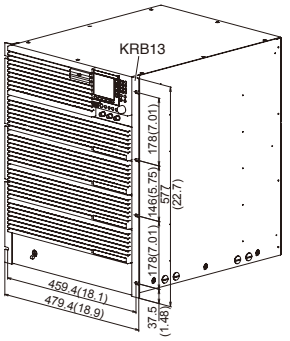


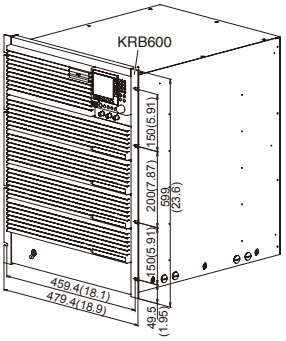




■ PLZ20005WH



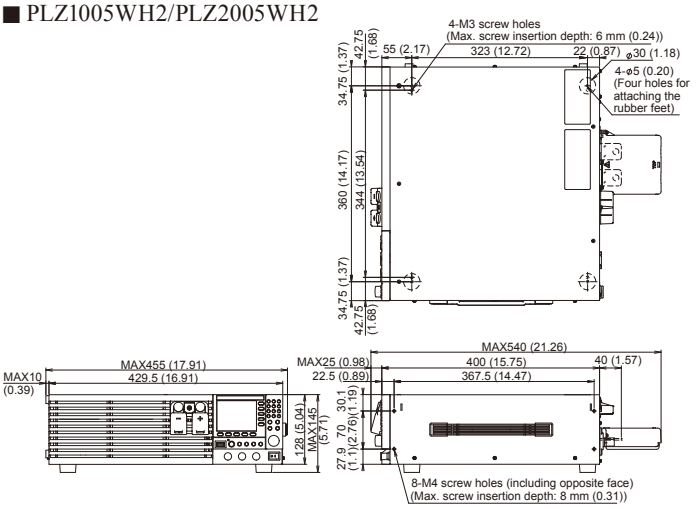




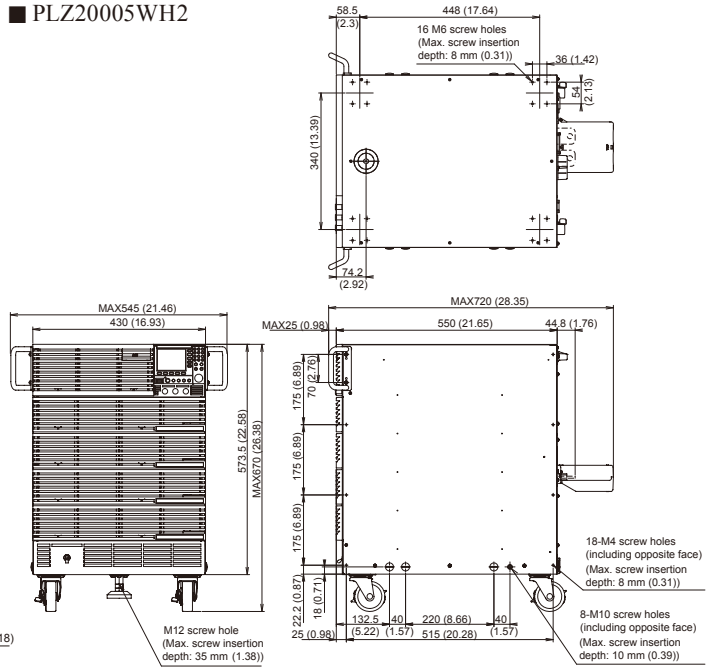
PLZ-5WH2 Series External Dimensional Diagrams/Rack Mount Option

Unit:mm (inch)

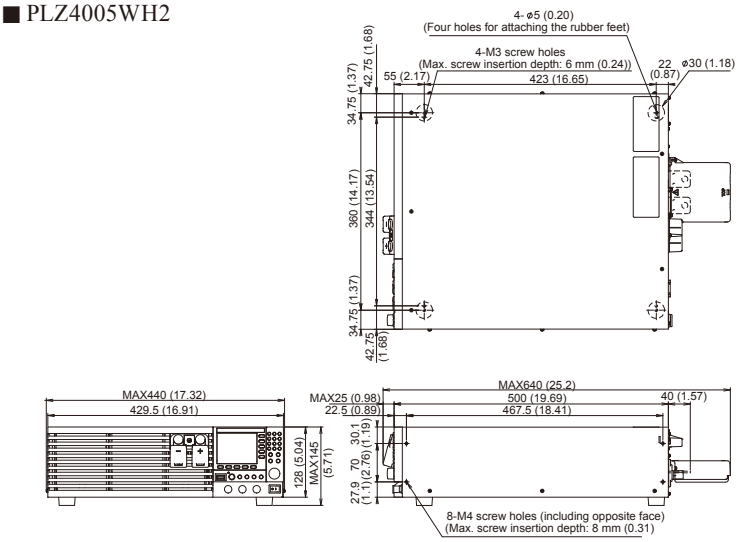
■ PLZ1005WH2/PLZ2005WH2



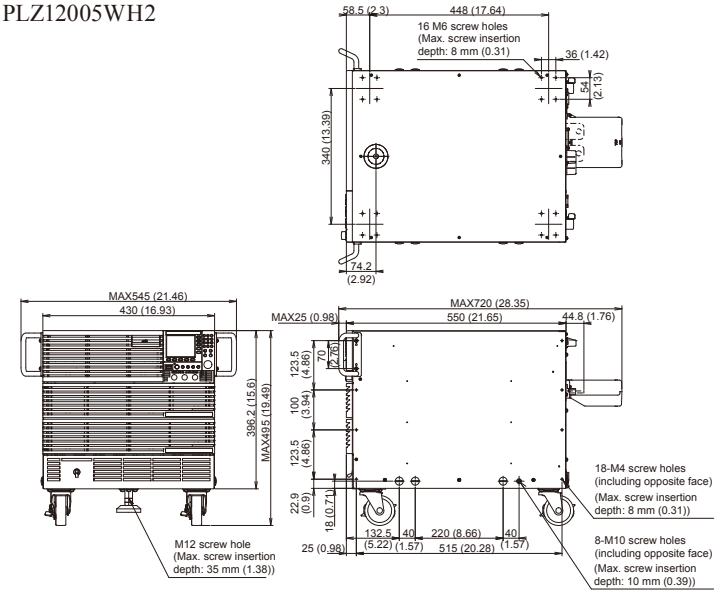
■ PLZ20005WH2



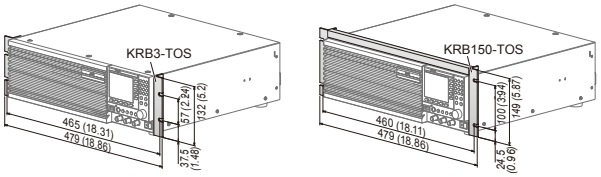
■ PLZ4005WH2



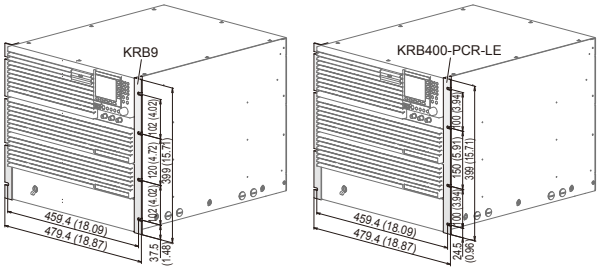
■ PLZ12005WH2



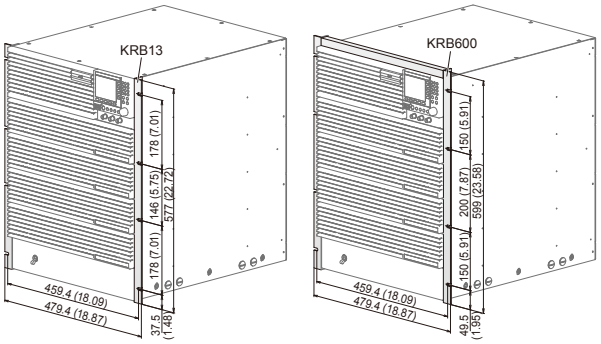
● PLZ1005WH2/PLZ2005WH2/PLZ4005WH2



● PLZ12005WH2



● PLZ20005WH2



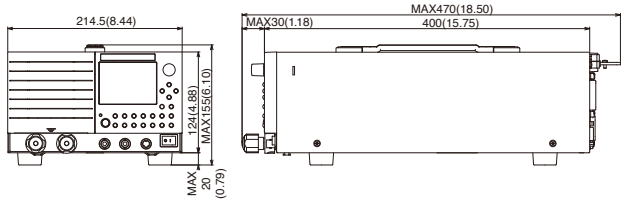
PLZ-4W Series External Dimensional Diagrams/Rack Mount Option

Unit:mm (inch)

■ TYPE I (PLZ-4W Series)

(2 units can be rack mounted)

PLZ164W/PLZ334W/PLZ164WA

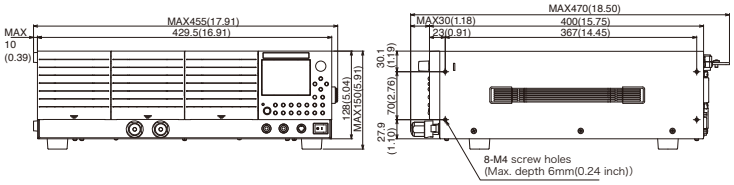


DC input terminals
(Rear) M8
(Front) M6
Input AC inlet

■ TYPE II (PLZ-4W Series)

*The length for Model PLZ2004WB is 550(600)mm

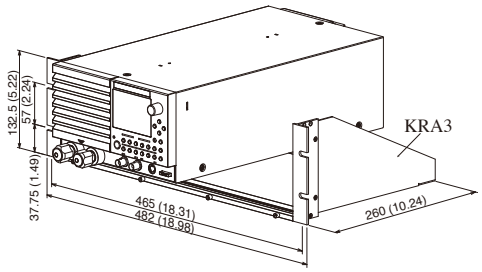
PLZ1004W/PLZ664WA

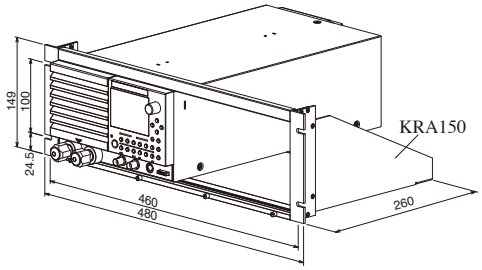


DC input terminals
(Rear) M8
(Front) M6

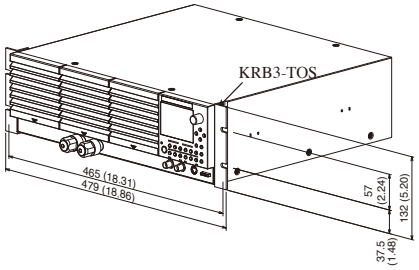
PLZ2004WB
DC input terminals
(Rear) M12
Input AC inlet

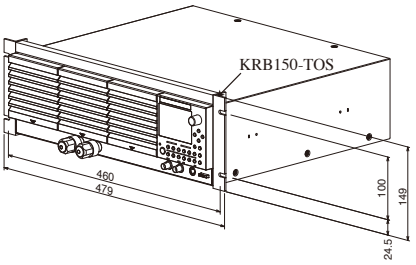
■ TYPE I (PLZ-4W Series)





■ TYPE II (PLZ-4W Series)





* The front panel for Model PLZ2004WB is designed differently, but external size is the same

PLZ-4W SR / LP Series External Dimensionals

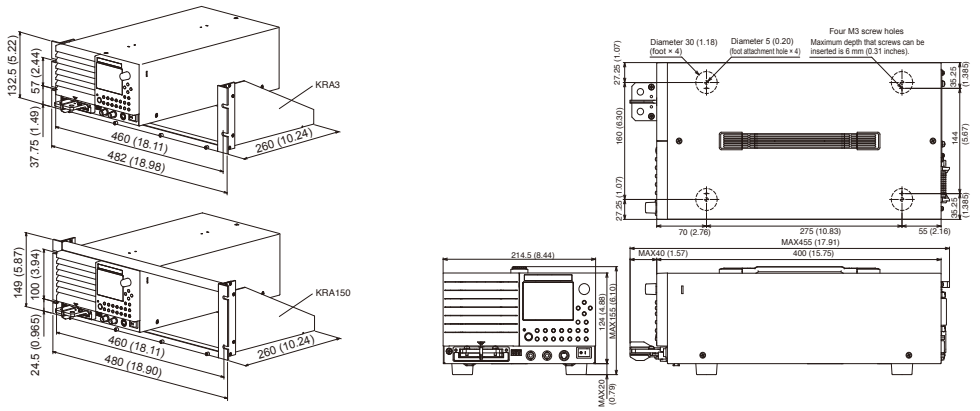
■ Dimensions (mm (inch) (Maximum dimensions))

PLZ5004W SR	432.6 (17.03") (545 (21.46")) W × 469.6 (18.49") (570 (22.44")) H × 764.7 (30.11") (955 (37,60")) D
PLZ7004W SR	432.6 (17.03") (545 (21.46")) W × 602.3 (23.71") (705 (27.76")) H × 764.7 (30.11") (955 (37,60")) D
PLZ9004W SR	432.6 (17.03") (545 (21.46")) W × 735 (28.94") (835 (32.87")) H × 764.7 (30.11") (955 (37,60")) D
PLZ9004W LP	570 (22.44") W × 1350 (53.15") (1435 (56.50")) H × 950 (37.40") (1020 (40.16")) D
PLZ11004W LP	
PLZ13004W LP	

PLZ-4WL Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

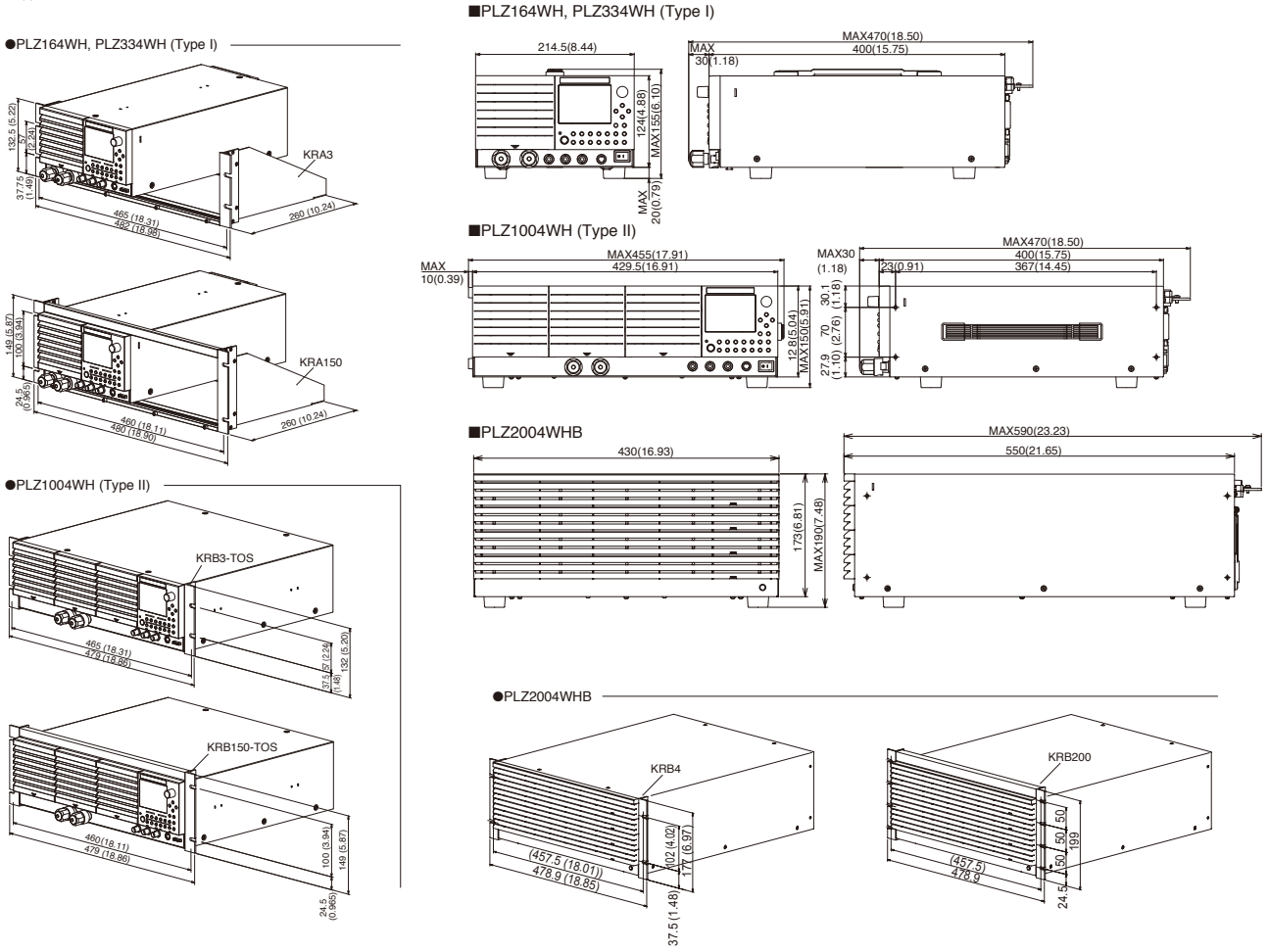
PLZ164WL
PLZ334WL



PLZ-4WH Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

PLZ164WH/PLZ334WH/PLZ1004WH
PLZ2004WHB



PLZ-4WH SR / LP Series External Dimensionals

■ Dimensions (mm (Maximum dimensions))

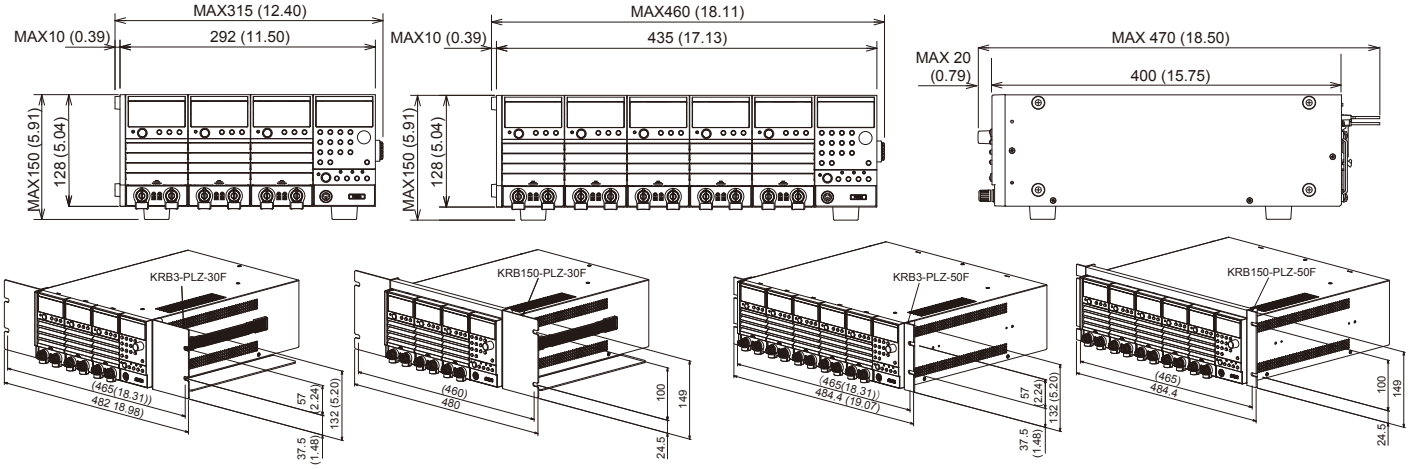
PLZ5004WH SR	432.6 (17.03") (545 (21.46")) W × 559.6 (22.03") (660 (25.98")) H × 764.7 (30.11") (955 (37,60")) D
PLZ7004WH SR	432.6 (17.03") (545 (21.46")) W × 737.3 (29.03") (840 (33.07")) H × 764.7 (30.11") (955 (37,60")) D
PLZ9004WH SR	432.6 (17.03") (545 (21.46")) W × 915 (36.02") (1015 (39.96") H × 764.7 (30.11") (955 (37,60")) D
PLZ9004WH LP	570 (22.44") W × 1350 (53.15") (1435 (56.50")) H × 950 (37.40") (1020 (40.16")) D
PLZ11004WH LP	
PLZ13004WH LP	

PLZ-U Series External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

PLZ70UA/ PLZ150U
PLZ-30F/PLZ-50F

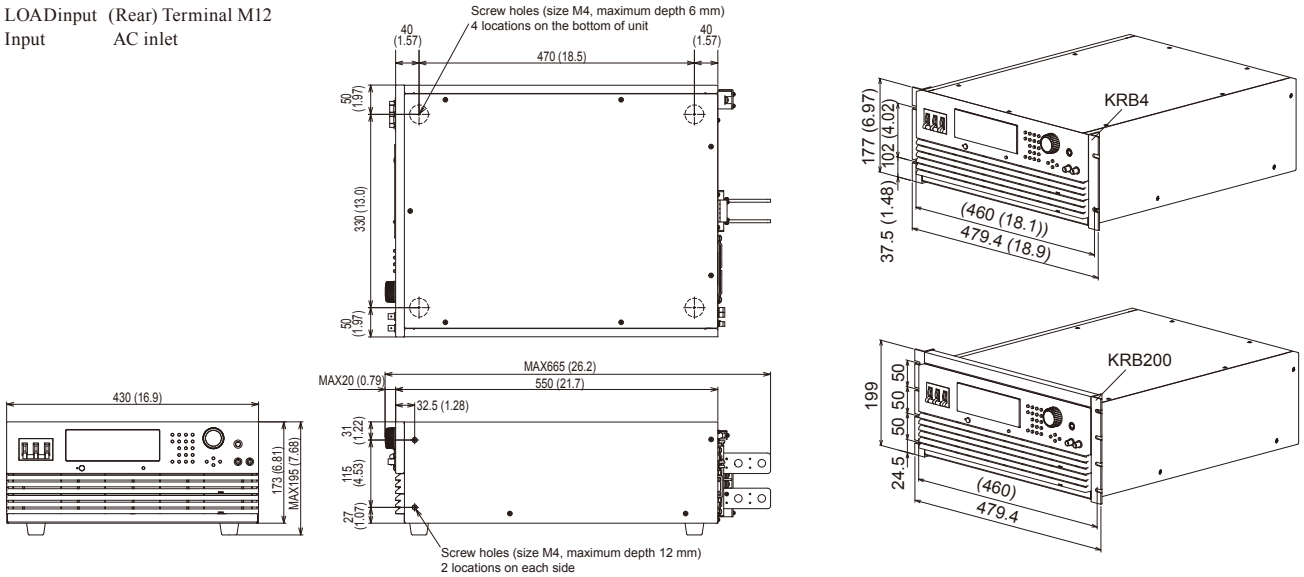
DC input terminals: (Rear) M6, (Front) M6
Input: AC inlet
Attached power cable: SVT3 18AWG 3P plug, Cable length 2.4 m



PLZ6000R External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

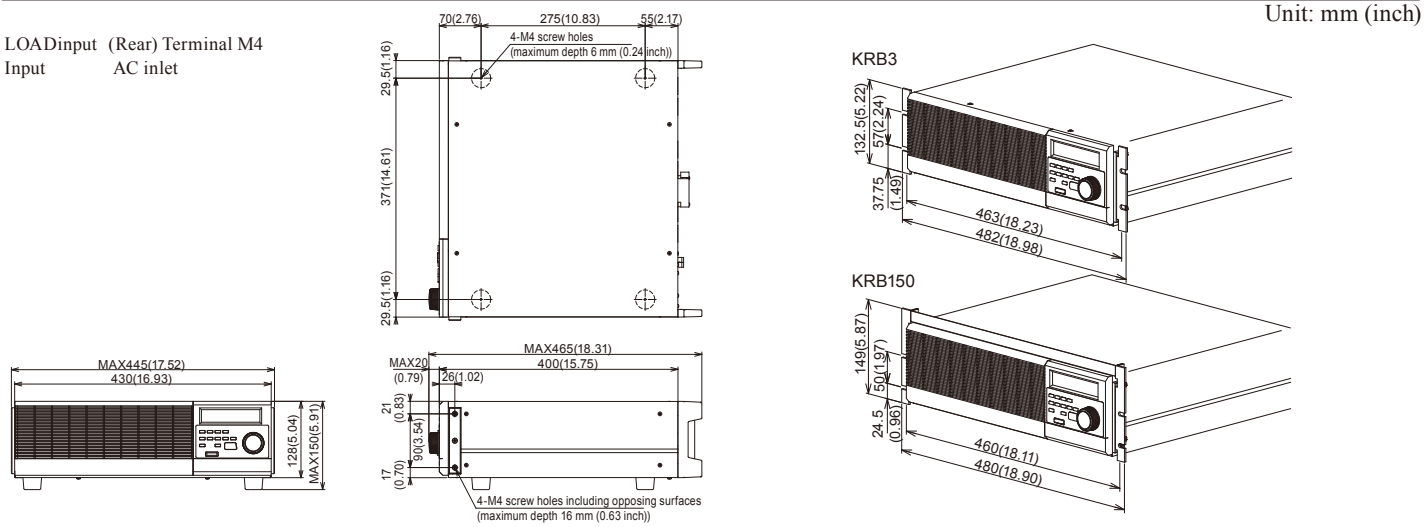
LOADinput (Rear) Terminal M12
Input AC inlet



PCZ1000A External Dimensional Diagrams/Rack Mount Option

Unit: mm (inch)

LOADinput (Rear) Terminal M4
Input AC inlet



■ An introduction to regulated DC power supplies

AN INTRODUCTION TO REGULATED DC POWER SUPPLIES

1. Why are Regulated DC Power Supplies Required?

Power supplies are generally defined as “sources that supply electricity” or “sources from which we derive power,” according to dictionaries. They can be broadly classified into AC and DC types. Of the two, AC power supplies include 100 V AC, 50/60 Hz for general home use, and 200 V AC, single-phase/three-phase for factory use.(in Japan) DC power supplies include dry batteries and the convenient general batteries. Dry batteries are easy to use, but do not always provide the desired voltage and current. For commercial power, on the other hand, we can utilize small to large power capacities without restraint; there’s no need to worry about the life of the power source. In Japan, commercial power takes the form of 100 V alternating current (AC). Alternating current periodically changes its magnitude of voltage and direction of current. However, most electronics circuits, including the transistors and ICs used for industrial equipment, consumer products, and other devices, operate on DC power. Thus, many regulated DC power supplies are used, to supply electronics circuits with a suitable voltage or current.

2.Types of DC Power Supplies

DC power supplies include non-regulated power supplies that simply combine rectifiers and capacitors, and a variety of regulated power supplies that utilize complex circuit technology.

2-1.Regulated Power Supplies

Regulated DC power supplies generally use commercial AC power to generate a constant DC voltage (or current) which is unaffected by input variations or load variations. They have the following features

- Constant output voltage (or current) even when input voltage (e.g.,100 V AC) varies (e.g.,from 90 V to 110 V)
- Constant output voltage even when a load fluctuates within the capacity of a power supply (e.g.,within a range of 0 to 2 A for a maximum output rating of 2 A)
- Small ripples
- High setting accuracy for output voltage (or current)
- Poor efficiency relative to non-regulated power supplies
- Expensive
- Suitable for a variety of applications

2-2.Non-regulated Power Supplies

Non-regulated power supplies are used when generation of the DC voltage is simplified; their output varies with external conditions (such as input voltage, load variations, and ambient temperature). Their features are as follows

- Output voltage varies almost in proportion with an AC input voltage
- Relatively large ripples, although these varies with load capacity
- Rigid
- Inexpensive

3. Configuration of Regulated DC Power Supplies

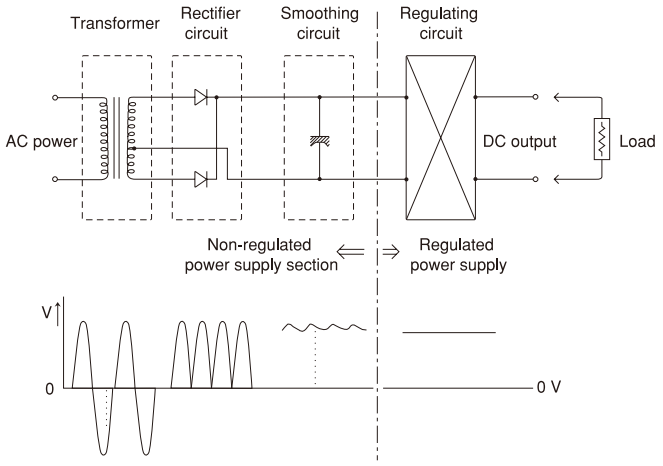
Regulated DC power supplies are broadly divided into

- Series regulators
- Switching regulators

Here, we describe the configuration of regulated DC power supplies, using a series regulator as an example. A regulated DC power supply consists of roughly the following four elements

- A non-regulated power supply section
- Regulating circuit
- Protection circuit
- Other auxiliary circuits

[Fig.1] Configuration of a Regulated DC Power Supply



3-1.Non-regulated Power Supply Section

This section converts AC into DC and consists of three blocks: a transformer, rectifier circuit, and smoothing circuit. Since no regulation occurs yet, this section is considered a non-regulated power supply.

■ Transformer

The transformer converts an AC voltage into an appropriate voltage and also isolates the output side from the AC input side.

■ Rectifier circuit

This circuit converts the AC voltage into the DC voltage. A variety of rectifier circuit systems are available, depending on the application required.

■ Smoothing circuit

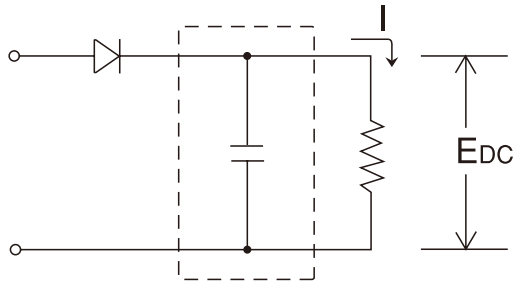
After an AC voltage has been rectified by the rectifier circuit, the output waveform still contains a pulsating current, i.e., it needs to be further smoothed. The circuit that handles this operation is called a smoothing circuit, and come in two types: capacitor input and choke input systems.

- Capacitor input system

In this system, a capacitor is inserted after the rectifier circuit in parallel to the circuit (Fig. 2); it has the advantage of providing high output voltage. However, there is a drawback that large voltage variations result from load variations.

■ An introduction to regulated DC power supplies

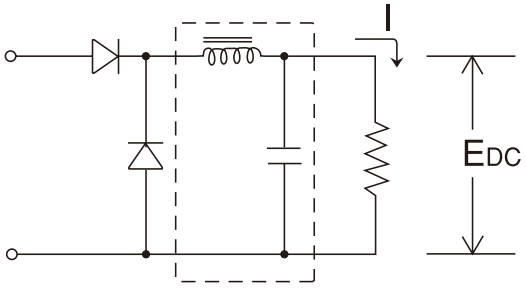
[Fig. 2] Capacitor Input System



● Choke input system

In this system, a choke is inserted after the rectifier circuit in series with the circuit (Fig. 3); it has the advantage of achieving good voltage regulation at a certain load current or higher. Its drawback is that the choke adds considerable weight to the system.

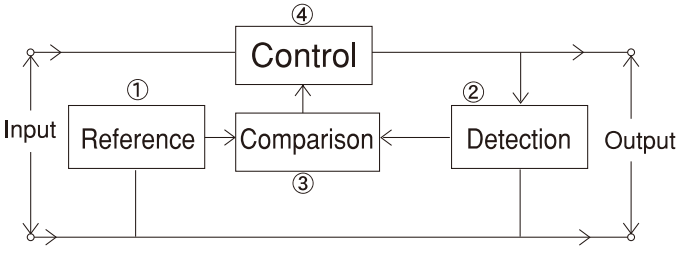
[Fig. 3] Choke Input System



3-2. Regulating Circuit

In the non-regulated power supply section explained so far, the output voltage fluctuates whenever the voltage of AC power varies or a load changes. A circuit that removes such variation to obtain constant voltage output is called a regulating circuit.

[Fig. 4] The Regulating Circuit Block

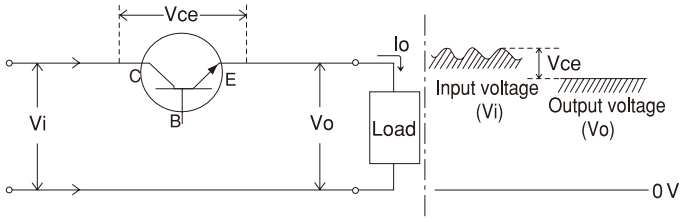


1. Reference: A block that determines the stability of a power supply. This block supplies a voltage which is as constant as possible.
2. Detection: Monitors the status of the output and feed back to the comparator circuit.
3. Comparison: Compares signals from the reference block and detection block and amplifies any error between.(Error amplifier)
4. Control: This block corrects the output voltage using with error signals sent from the comparator circuit. For DC power supplies, a large-capacity transistor is used in this block; the block itself is called a control transistor.

As this example shows, because the control transistor is installed in the circuit in series with the load, this circuit is called a series regulator (or "series control system").

The input voltage (Vi) is set to a value (Vce) several volts higher than the output voltage (Vo), in order to eliminate ripple and provide a margin for variations in AC power. (Fig. 5)

[Fig. 5] Series Regulator



Thus, if a load current flows, power equal to the product of that current (Io) and the Vce is consumed in the control transistor to be dissipated as heat.

To prevent the control transistor and other circuit parts from being damaged by this rising heat, various forms of cooling are available, including natural convention cooling (heat sink), forced fan cooling, and other means.

3-3.Protection Circuit

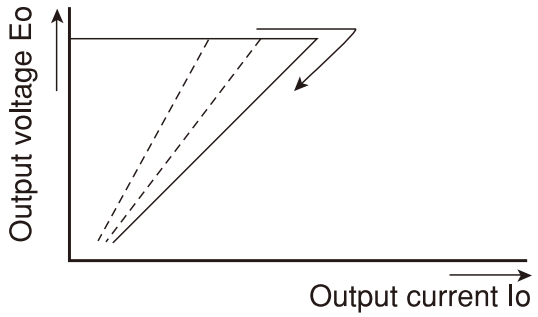
In constant-voltage power supplies, if the output terminals are short circuited, an excessive current is produced, thus damaging circuits or the series control power transistor, due to very low output impedance. Thus, all constant-voltage power supplies require a protection circuit that prevents excessive current from being output.

Protection circuits can be broadly divided by type into folded-back protection circuits (wedge-shaped protection circuits) and constant current/voltage automatic crossover protection circuits (drooping characteristics).

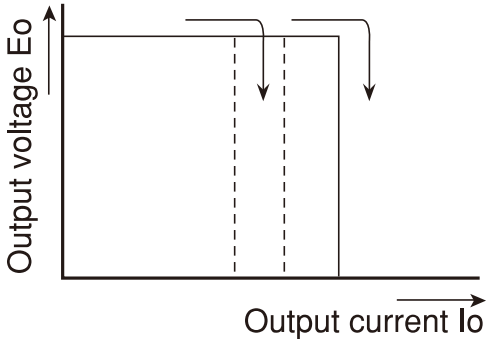
All standard regulated DC power automatic crossover sold by Kikusui use a constant current/voltage automatic crossover protection circuit.

■ An introduction to regulated DC power supplies

[Fig. 6] Wedge-shaped protection circuit



[Fig. 7] Constant Current/Voltage automatic crossover Protection Circuit (Drooping Characteristics)



3-4.Other Circuits

The circuits described above are basic configuration elements. To enhance compactness and operating performance, a pre-regulator circuit, bleeder circuit, and overvoltage protection circuit are also employed.

■ Pre-regulator circuit

If the Vce in (Fig. 5) is too large, the heat generated by the transistors increases, which causes additional problems, e.g., increased number of power transistors and higher enclosure temperatures. To solve these problems, measures need to be taken to vary the input voltage based on the output voltage. This can be accomplished in one of several ways, such as by providing taps in the transformer to switch relays or other parts, or by configuring a control rectifier circuit (using a thyristor) in order to control the rectifier circuit.

● Relay method

This method has several advantages: the circuit becomes relatively simple, for instance, and noise and other unwanted signals are extremely low unless relay switching is in progress. However, it has its drawbacks as well. Large relays are required to handle the large capacity of power involved; also, the power transistors unavoidably produce high levels of heat because of the small number of switching points available. Thus, this method is often used for power supplies having relatively small capacity.

● Thyristor method

This method results in a complicated circuit. However, since the output voltage of the rectifier circuit can be varied continuously, the Vce in (Fig. 5) can be always maintained at a constant level. Thus, less wasted heat is generated and the outside shape is smaller, relative to when the relay method is used. Consequently, this method is frequently used for large-capacity power supplies. However, it does have the drawback of generating unavoidable thyristor noise, and precautions should thus be taken when using this method in areas where radiation is a problem.

■ Bleeder circuit

When the output terminals are fully opened, problems arise with increased voltage between the output terminals, due to leakage current from power transistors. Moreover, current charged in a capacitor between the output terminals needs to be dischanged when the output voltage is to be lowered rapidly; a bleeder circuit handles this function.

■ Overvoltage protection circuit (OVP)

This circuit protects a load from breakdown or burning caused by overvoltage generated by a failure of a power supply. It is essential for loads to which overvoltages are never applied or for devices left unattended over long periods.

OVP circuits come in several types, including a slow-speed type (about 50 ms) that detects overvoltage to cut off a no-fuse breaker, and a high-speed type (about 200 ms) that forms a short circuit between the output terminals using a thyristor. The high-speed type is considered suitable for semiconductor loads, while the slow-speed type is more appropriate for such as motor loads. The correct type needs to be chosen based on anticipated load conditions.

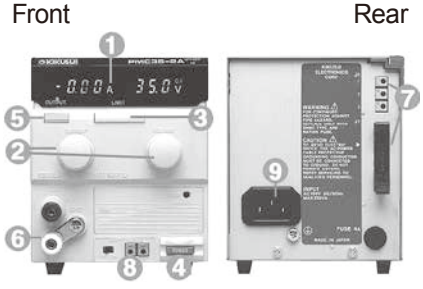
● Other protection circuits

- Overheat protection circuit
- Temperature fuses
- Input and output fuses
- Input cut-off using external contact points

4. Functions of Regulated DC Power Supplies

In this section, we describe the general functions available for the output-variable regulated DC power supplies used in laboratories and on production and inspection lines.

* When actually using a regulated DC power supply, always refer to the Operation Manual carefully.



■ An introduction to regulated DC power supplies

1.Voltmeter and ammeter
This part displays the values of voltage and current being output. Today, LED-based digital display systems are commonly used.

2.Voltage and current setting knobs
Used to set output voltage and output current values. Knobs come in two types: those change from 0 to FS (full scale, or maximum rating) in a single turn, and ten-turn type (potentiometers) that allow finer settings.

3.Voltage/current limit setting switch
Used to set the values of output voltage and/or output current limits to protect a load or accomplish other purposes.

4.POWER on/off switch
Turns the power on/off.

5.OUTPUT on/off switch
Turns the output on/off.

6.OUTPUT terminals
Terminals for obtaining the output. A red, white or black colors are used. The terminal between the positive red and negative white or black terminals is the ground (common) terminal. By connecting it to the positive or negative terminal using the supplied jumper, the polarity can be changed. The ground terminal can also be used in a floating condition without connecting the jumper. Moreover, for the terminals handling large output capacity (i.e., high voltage or large current), a large terminal block is provided (instead of binding posts) at the rear of the unit.

7.External analog and remote control (I/O) terminals
Allow the settings for output voltage and output current values to be controlled using an external voltage or resistor, and the output's ON/OFF setting to be controlled using an external contact signal. These terminals are used for links with other equipment or a remote control. They may also be equipped with terminals used for master-slave-control serial or parallel operations, or with output terminals for monitoring voltage and current values, among other terminals.

8.Remote sensing terminals
When the wiring distance to a load is long the voltage value at the load end may be lower than the output set value due to the resistance of the wiring. In such cases, the location of voltage detection can be moved to the load end. This change enables a voltage drop to be compensated. (The voltage compensation range differs by product. For more information, check the relevant catalogs or other documentation.) This feature is called “remote sensing”.

9.AC inlet
AC power input terminal, for use by an AC power cable. For products that handle large input current, an AC power cable capable of being connected to a large terminal block by crimp contacts may be used.

5. Terms Used for Regulated DC Power Supplies

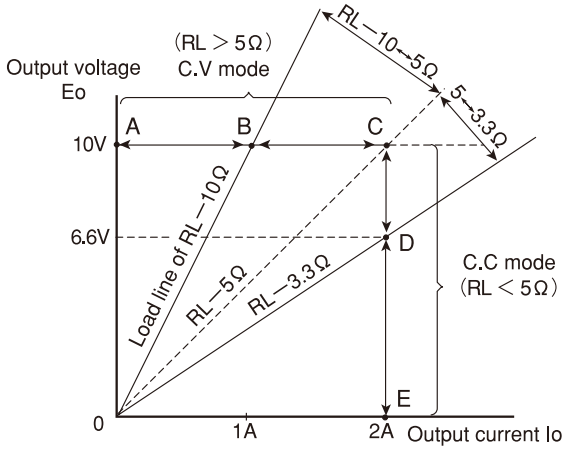
Key terms used in catalogs and other documentation for regulated DC power supplies are explained below.

● Constant Voltage (CV) and Constant Current (CC) modes
In regulated DC power supplies, output voltage may, in some cases, not change even when a load changes, or output current may not change even when a load changes. The former case is called “constant voltage” mode; the latter, “constant current” mode. “Constant voltage” is sometimes shortened to“CV,” and “constant current,” to “CC”.

● Constant Voltage (CV) operation
Output from regulated power supplies is expressed using two values: voltage (unit: volt) and current (unit: ampere). Operations in which voltage is kept at a constant level regardless of load value are called “constant voltage” operations.
For example, if the output voltage Eo is 10 V and 10 ohm is connected as the load RL, an output current of Io = Eo/RL = 10 V/10 ohm = 1 A flows according Ohm’s law. An output current Io = 10 A flows when the load is 1 ohm, and Io = 100 A when the load is 0.1 ohm , to maintain an output voltage of 10 V. Power supplies that operate this way are called “constant voltage” power supplies, and are almost equivalent to dry batteries and general batteries.
In actual constant voltage power supplies, the output current is limited to a certain capacity. (KIKUSUI products allow you to set this current limit value arbitrarily, using a current setting knob). When the output current is limited, the output voltage drops, causing the CV lamp to go off and the CC lamp to light up. Even if load resistance is further minimized to ultimately cause a short circuit, the output current will not exceed the set value (the power supply has a constant current characteristic). Regulated power supplies will automatically change from constant voltage to constant current operations in this way to prevent an overcurrent from flowing into the load. (This is known as an automatic CV/CC crossover system). (Fig. 8) shows the operating points by expressing load lines in the operation region.
When the output voltage Eo = 10 V and current limit value is set to 2 A, the operation point is located at the point A in a no-load condition. The operation point moves to the point B and then to the point C in the constant voltage region when the RL changes first to 10 ohm and then to 5 ohm, respectively. When the load resistance is further minimized from 5 ohm to 3.3 ohm, the operation point moves from the point C to D, entering the constant current region (the point C is called a crossover point). When the load resistance RL = 3.3 ohm, the output voltage Eo = Io × RL = 2 A × 3.3 ohm = 6.6 V. If the load resistance is further reduced to be short circuited, the operation point reaches the point E.

■ An introduction to regulated DC power supplies

[Fig. 8] Constant Voltage and Constant Current Operations



● Constant Current (CC) operation

Output of regulated power supplies is expressed in two values: voltage (unit: volt) and current (unit: ampere). An operation in which the set current is kept at a constant level, regardless of load value, is called a "constant current" operation.

For example, if 3.3 ohm is connected as the load RL to a constant current power supply of which output current has been set to 2 A, the output voltage Eo becomes Eo = Io × RL = 2 A × 3.3 ohm = 6.6 V according to Ohm's law. When the load capacity increases, the power supply increases the output voltage to 10 V at a load of 5 ohm and then to 20V at 10 ohm, to continue supplying a set current value of 2 A. However, in actual constant current power supplies, the output voltage cannot be increased endlessly, but will be limited at a certain level. (KIKUSUI products allow you to set this value arbitrarily, using a voltage setting knob). (Fig. 8) shows these characteristics.

When the constant output current value is set to 2 A, the output voltage to be limited is set to 10 V, and load RL = 3.3 ohm is connected to the power supply, the operation point is located at the point D. When the resistance value is increased to RL = 5 ohm, the operation point moves from the point D to C. When the resistance is further increased to RL = 10 ohm, the operation point moves from the point C to B, entering the constant voltage region. This causes the output current to be reduced (a constant voltage operation is no longer performed). If RL is further increased to finally open, the operation point moves from the point B to A, preventing a voltage exceeding the set value 10 V from being applied to the load (In this way, the regulated power supplies are capable of automatically changing from the constant current operation to constant voltage operation to protect the load). The operation point C in (Fig. 8) is called a "crossover point".

● Output voltage stability (in constant voltage operation)

- Power variations: Variations in the output voltage relative to a variation of ± 10 % of the AC input voltage (90 V to 110 V AC)
- Load variations: Variations in the output voltage when the load condition changes from 0 to 100 % (from no load to full load) (Note that these variations do not include transitional variations.)

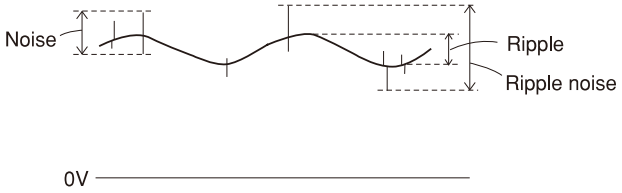
● Output current stability (in constant current operation)

- Line Regulation: Variations in the output current relative to a variation of ± 10 % of the AC input voltage (90 V to 110 V AC)
- Load Regulation: Variations in the output current relative to load variations when output is short circuited (voltage: 0 V) to the maximum rated output voltage

● Ripple noise

- Ripple: A pulsating current component superimposed on the output is called a "ripple". As a frequency component, it is an alternating current input frequency and an integral multiple of that frequency.
- Noise: A random, unwanted electrical signal present in output. In Kikusui Electronics, a ripple and noise of 5 Hz to 1 MHz are together called "ripple noise." It is expressed in "rms" (root-mean-square value) or "p-p" (peak to peak).

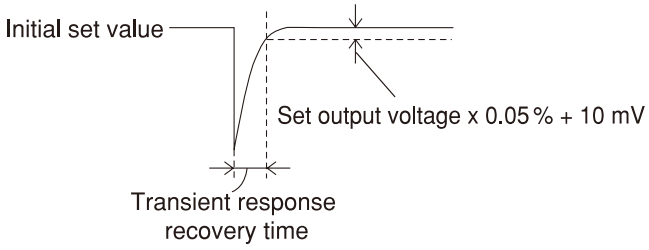
[Fig. 9] Ripple Noise



● Transient response recovery time (in constant voltage operation)

The response time taken by the output voltage to return to the initial set value when the load condition changes suddenly. It is also simply called "transient response."

[Fig. 10] Transient Response Recovery Time

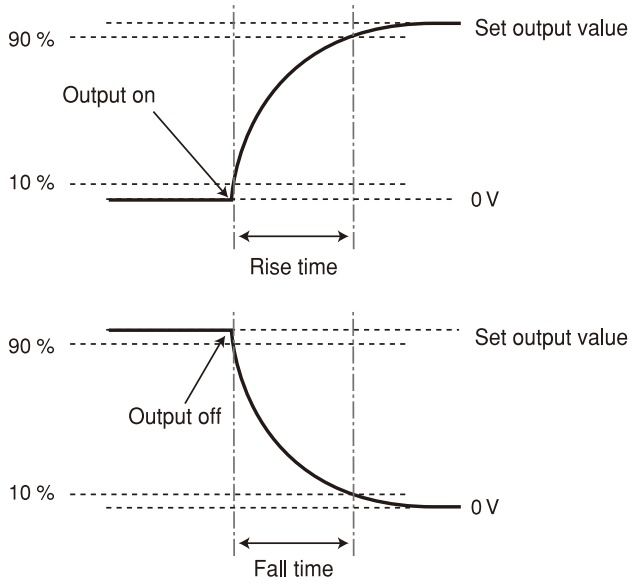


■ An introduction to regulated DC power supplies

● Rise time/fall time

When the output is turned on, the output voltage or current takes time to reach 90 % of the maximum rate of change (from 0 V to a set value) from 10 %. This response time is called “rise time.” Conversely, the response time taken by the output voltage or current to reach 10 % of the rate of change from 90 %, when the output is turned off is called“fall time.” These terms are also called “rise” and “fall,” respectively.

[Fig. 11] Rise Time/Fall Time



● Isolation voltage

In case when output terminals are isolated; its Hipot is also known as “isolation voltage.” When a few power supplies are operated in series, if the sum of their maximum output voltages exceeds the isolation voltage, electric shock becomes a risk. (For example, two power supplies having a maximum output voltage of 500 V and an isolation voltage of ±500 V cannot be operated in series.)

● Temperature coefficient

The rate of change in output caused by a change in ambient temperature of 1 °C. For example, the power supply of which temperature coefficient is 50 ppm/°C, if the ambient temperature changes by 5 °C, the rate of change in output is equal given as: output voltage × 50 × 10^{-6} × 5.

■ Basic principles of power supplies

BASIC PRINCIPLES OF POWER SUPPLIES

1.Regulated DC Power Supplies

Regulated DC power supplies generate DC power for operation of electronic devices and other equipment from alternating current supplied by commercial power lines. Regulated DC power supplies can be categorized broadly into constant voltage power supplies, which keep output voltage constant, constant current power supplies, which keep output current constant, and constant voltage/current automatic crossover power supplies, which combine the features of both. Each can be further classified into variable and fixed types of output voltage or output current. The configuration of these devices generally consists of a power transformer to which an AC voltage is applied to increase or decrease voltage, a rectifier and smoothing circuit that converts AC voltage into DC voltage, and a control circuit that keeps output voltage or output current constant, in the presence of voltage variations, load variations, and temperature changes. Regulating methods include shunt-regulating, series-regulating, and switching-regulating systems, commonly referred to as shunt regulators, series regulators, and switching regulators, respectively. Some power supplies use a combination of all these systems. In addition to their power-supply capabilities, many variable-type power supplies are equipped with digital meters to display output voltage or current. In the following, we describe series-regulating and switching-regulating systems, the primary systems embodied in modern power supplies.

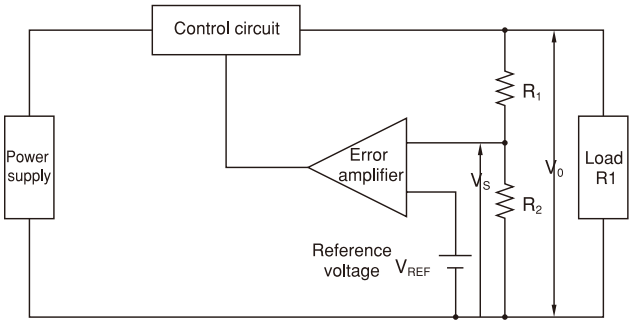
1-1.Principles of regulation

The principles of regulation for constant-voltage and constant-current power supplies are described.

1.Constant voltage power supplies

[Fig. 1] shows the basic circuitry for a constant voltage power supply.

[Fig. 1] Basic circuitry for a Constant Voltage Power Supply

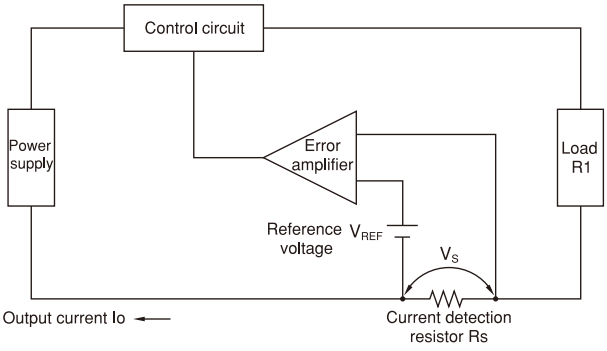


The power supply in the figure feeds power to the load R_1. The control circuit controls a load voltage according to a signal from the error amplifier. The error amplifier compares the reference voltage VREF and the voltage Vs, obtained by dividing the output voltage Vo by those resistors the R_1 and the R_2. It then outputs the signal for the difference to the control circuit to equalize the VREF and the Vs, which enables the device to output a constant voltage.

2.Constant current power supplies

[Fig. 2] shows the basic circuitry for a constant current power supply.

[Fig. 2] Basic circuitry for a Constant Current Power Supply



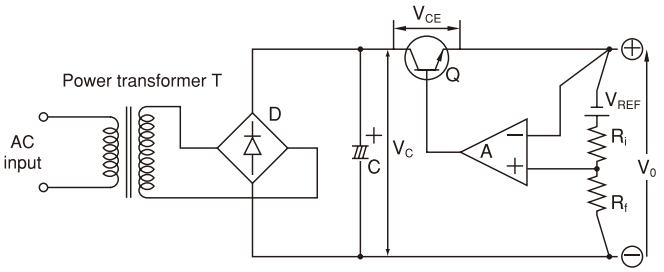
The functions of the power supply, control circuit, and the error amplifier in this figure are the same as those described for constant voltage power supplies. But the voltages compared by the error amplifier are VREF and the voltage Vs generated when the output current Io passes through the current detection register Rs. The error amplifier outputs the signal for the difference to the control circuit to equalize VREF and Vs, which enables the device to output a constant current.

■ Basic principles of power supplies

1-2.Series regulating system

[Fig. 3] shows the basic circuitry for a series regulating system power supply.

[Fig. 3] Basic circuitry for a Series Regulating System



In this circuit, the series transistor Q is equivalent to the control circuit in Fig. 1. The AC input, power transformer T, rectifying bridge diode D, and smoothing capacitor C are as found in the power supply above. This is called a capacitor input-type rectifier circuit.

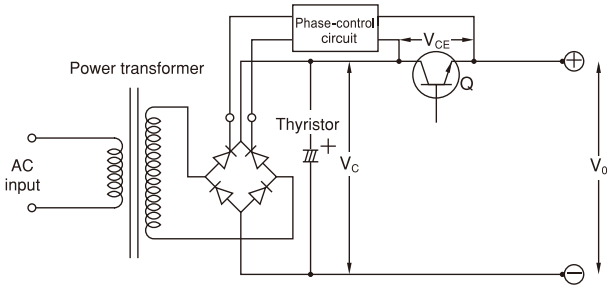
Now, assuming that the amplifier A and the series transistor Q are ideal, the output voltage Vo can be expressed by

$$V_0 = \frac{R_f}{R_i} \cdot V_{REF}$$

The output voltage Vo is regulated at a constant level if the Rf, Ri, and VREF are constant. Moreover, changing the Rf allows the output voltage to vary. This system permits a wide range for output voltage, superior stability and transitional response characteristics, and low ripple and noise. Note that setting a low output voltage causes the VCE of the series transistor Q to increase, while setting a large output current causes the collector loss of Q to increase. This can be avoided by changing the voltage Vc of the smoothing capacitor according to the output voltage Vo. For example, taps in the power transformer can be switched by using contacts, such as relays or other elements. The current mainstream method is to use semiconductors such as thyristors to control (phase control) the conducting angle of the power transformer AC output.

[Fig. 4] shows the basic circuitry for a phase control-type pre-regulating system, using a thyristor.

[Fig. 4] Phase-control circuit Using a Thyristor



For the phase-control circuit shown in the figure, a pulse phase modulator synchronized with power frequency will narrow the conducting angle if the VCE of the series control transistor increases, or broaden the conducting angle if the VCE decreases. That is, since the thyristor is controlled so that the VCE is constant, the phase-control circuit can operate without increasing collector loss for the series transistor Q.

Thyristor-controlled series regulating systems offer quick response, low noise, and efficiency, their typical reliance on commercial-frequency power transformers results in heavy, cumbersome design.

Currently, this system is used most often in regulated DC power supplies of moderate to greater power. In environments requiring miniaturization and high efficiency, series regulating power supply systems (except for special uses) are being replaced by those of the switching regulating variety, described below.

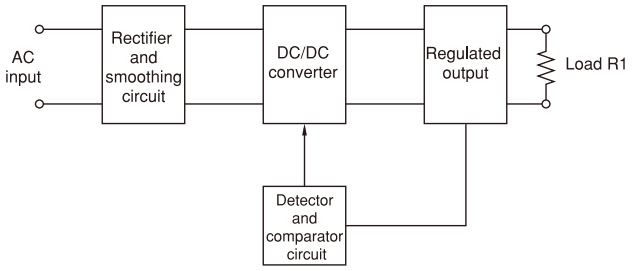
1-3.Switching regulating system

Recent trends have made compact size, low weight, and high efficiency much sought-after characteristics for electronics devices. Regulated DC power supplies are common components of these devices, replacing conventional power supplies which can't meet their special requirements. Compact, lightweight, and capable of high efficiency, switching regulators are quite popular.

Compared to series regulators, switching regulators are 1/10 to 1/2 in weight and 1/10 to 1/3 in size. They also achieve efficiency around 70 % to 90 %, whereas series regulators typically reach the 30 % to 60 % range. Switching regulators also have wide-input voltage ranges - some can be used in 85 to 264 V AC range without modifications. On the debit side, their high-speed power switching generates noise, and their stability and high-speed characteristics are inferior to series regulators. The use of shields to alleviate noise permits use under most circumstances (with some exceptions).

[Fig. 5] shows the principle diagram of the switching regulators.

[Fig. 5] Basic Configuration of a Switching Regulator



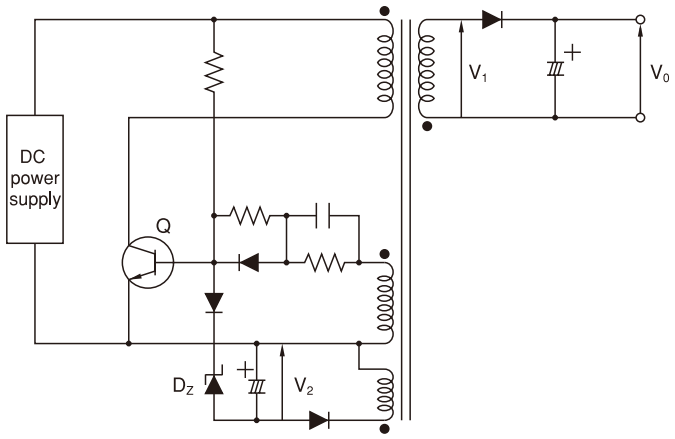
A switching regulator converts AC input into direct current using a rectifying bridge diode and smoothing capacitor, and switches direct current at high speed using a switching element. It then rectifies and smoothes the current again, then passes it for output to the DC/DC converter, which produces the desired DC output. Based on feedback from the constant voltage or constant current comparator circuit, the DC/DC converter circuit system alters switching frequency and the ratio of on/off (or 'duty') of the switches to obtain the regulated output. The following provides some examples of the main DC/DC converter circuit systems in current use.

■ Basic principles of power supplies

1.Ringing choke converters

[Fig. 6] shows a typical circuit for a ringing choke converter.

[Fig. 6] An Example of a Ringing Choke Converter



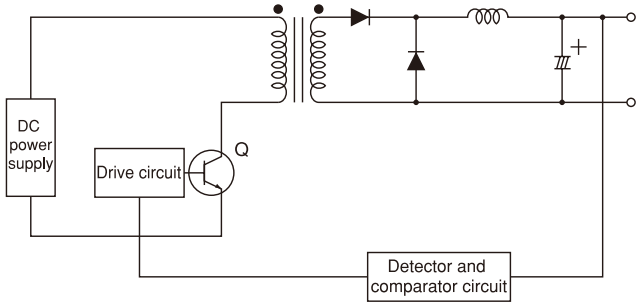
Ringing choke converters are self-excitation circuits of an on/off system. Composed of a small number of parts, they are characteristically used in small-capacity power supplies (several W to several tens of W) for which low cost is important. The stabilization of this circuit can be explained as follows: When output voltage increases, the voltage V_1 of the secondary winding increases, raising the detection voltage V_2 proportional to the V_1. When the V_2 increases to render the constant voltage diode Dz conducting, the base current of transistor Q (a switching element) falls to turn off the Q. This system keeps output voltage constant. But since a feedback amplifier is omitted, stability is poor. Uses requiring high stability often employ a system that has a feedback amplifier on the secondary side regulates output voltage through a photo coupler.

Ringing choke converters are frequently used as auxiliary power supplies or as pre-regulators for low-capacity series regulators.

2.Forward converters

[Fig. 7] shows the basic circuitry for a forward converter.

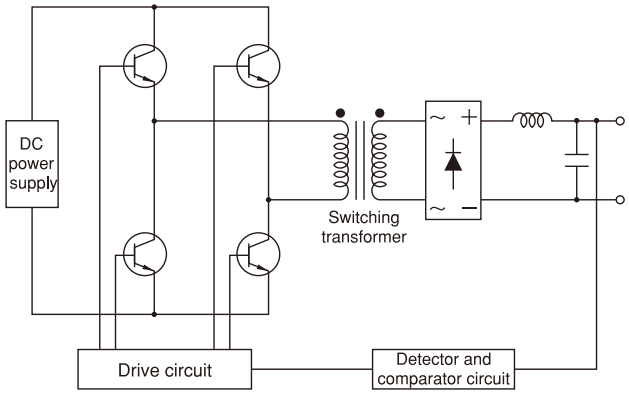
[Fig. 7] Basic circuitry for a Forward Converter



The forward converter system maintains constant output by controlling the on/off ratio of the switching element. In the ringing choke converter, a triangular-wave current flows in the switching element, while in this system, a square wave current flows; greater power can be converted if the same switching element is used. The forward converter system is used for power supplies of moderate or greater capacity, and has a broadening range of applications.

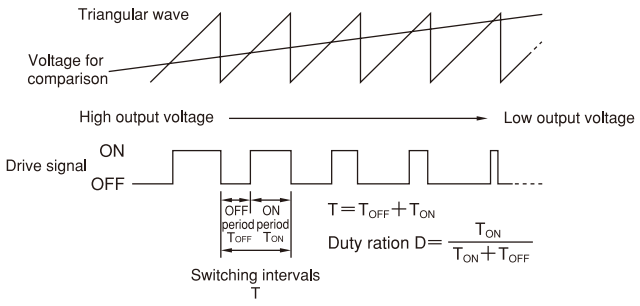
[Fig. 8] shows a full-bridge circuit using the forward converter system.

[Fig. 8] Bridge Circuit Applying the Forward Converter System



Compared to the system shown in [Fig. 7], this system makes greater use of the switching transformer, is more compact, and is capable of handling greater capacity. It is used for large-capacity power supplies. As we mentioned, regulation of the output voltage or output current of the forward converter system is achieved by controlling the duty ratio.[Fig. 9] illustrates this principle.

[Fig. 9] Operational Principle of Duty Ratio Control



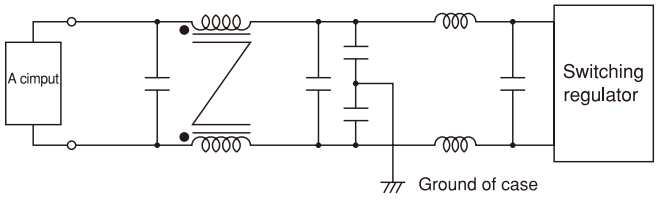
■ Basic principles of power supplies

A forward converter system as shown in [Fig. 7] compares voltage output from the comparator circuit that measures output voltage and current to the triangular wave that represents the reference voltage. The switching transistor Q remains in ON state when the voltage of the triangular wave is high.

Switching power supplies generate high-frequency noise due to their switching characteristics. Since this noise has undesirable effects on other electronics devices, the use of switching power supplies is often regulated or voluntarily restricted, with the nature of the restrictions varying from country to country. Standards bodies such as the FCC and CISPR impose limitations on the use of switching power supplies, while the Japan's VCCI and other standards recommend voluntary restrictions. Regulation of these power supplies generally varies between consumer electronic devices, manufactured for home use, and industrial electronic equipment used in factories and industrial sites. For consumer electronics devices, noise generation is typically restricted to a lower level than for industrial equipment. To prevent noise emission, switching power supplies are equipped with a noise filter on the input side.

[Fig. 10] shows one example of a noise filter arrangement.

[Fig. 10] Example of the Insertion of Noise Filter



As shown in the figure, the capacitor that suppresses common mode noise is placed between the input line and ground. This results in a leakage current from the power supply, which can produce electric shock if it reaches certain levels. Proper precautions including properly grounding of the filter are necessary.

1-4.Protection circuits

1.Overvoltage protection

In the case of a power supply failure or operator error, overvoltage may be applied to a load, resulting in breakdown. An overvoltage protection circuit should be equipped to prevent such occurrences. This feature is required for power supplies operating unattended over long periods.

Overvoltage protection circuits come in several types, including a type that detects overvoltage and shuts down the input using a breaker, and a type that creates a short circuit between the output terminals of a power supply using a thyristor. The overvoltage protection circuit type should be chosen according to the load to be connected.

2.Overload protection circuits

Constant voltage power supplies have very low output impedance. Since an output short-circuit can result in circuit-damaging overcurrent, a protective circuit to prevent such overcurrent is necessary. The types of overload protection circuits can be broadly divided into the following.

• Folded-back protection circuits (wedge-shaped protection circuits)

• Constant voltage/current automatic crossover protection circuits

Kikusui's constant voltage power supplies use a constant-voltage/current-shifting protection circuit.

3.Inrush-current prevention circuits

When input power for power supplies is switched on, a large inrush current can occur for a number of reasons, including magnetic saturation of the transformer or charge to a smoothing capacitor. Inrush-current prevention circuits are designed to protect against this current. Units may be equipped with circuits that place a resistor on the input side in parallel with a Triac or thyristor to limit an inrush current as the capacitor voltage increases. Since the design for this circuit presumes use of just one power supply, serious consideration should be given for an input switch in cases involving the incorporation of a number of power supplies.

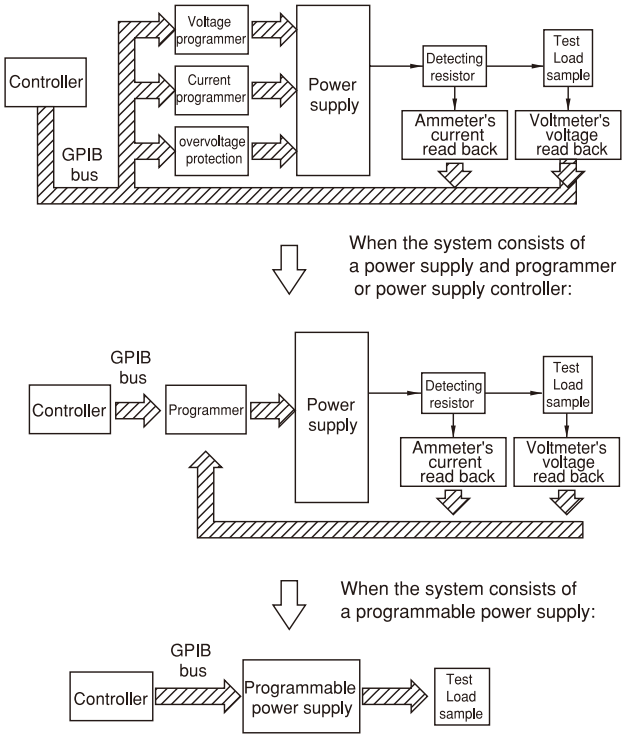
2.Programmable DC Power Supplies

One frequent requirement for recent electronic devices and equipment has been capacity for integration into automatic systems, in order to improve work efficiency. Programmable power supplies are well-suited to such needs. Some programmable DC power supplies come with, or can optionally be installed with, interface boards for GPIB and RS-232C.

[Fig.11] gives an example of a programmable DC power supply system.

■ Basic principles of power supplies

[Fig. 11] Sample Configuration of a Programmable DC Power Supply System

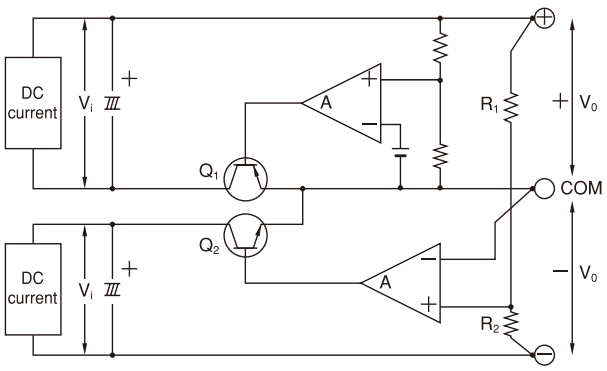


3.Multi-output DC Power Supplies

Multi-output DC power supplies are capable of simultaneously supplying power output for several lines from one power supply, with one knob controlling positive and negative voltages in a dual-tracking system providing two output lines.

[Fig. 12] shows basic circuitry for a dual-tracking system.

[Fig. 12] Basic circuitry for a Dual-Tracking



4.Regulated AC Power Supplies

Regulated AC power supplies can be categorized as AC stabilizers (AVR) that maintain constant output voltage or waveform, and frequency converters (CVCF) that maintain constant output frequency (or vary output frequency), in addition to the noted function.

Both types must demonstrate superior stability for output voltage (including output frequency in case of frequency converters), high-quality output waveform characteristics (e.g. low distortion) regardless of input voltage waveforms, and constant supply of power regardless of load types (power factor and others). Regulated AC power supplies thus require a set of operational characteristics differing from those for regulated DC power supplies.

The commercial power supply remains susceptible to power failures and voltage drops resulting from unavoidable natural phenomena, such as lightning, wind, rain, and snow. Additionally, the variety of loads encountered in factory production lines and in offices and residential areas has resulted in the supply of power containing waveform distortion, noise, or other unwanted signals due to the effects of electronic devices with capacitor-input-type rectifier circuits, such as TVs, PCs, and other office automation equipment.

Such power supply abnormalities may lead not only to damage or destruction of CPU-based equipment, but to much graver consequences, including serious injury. Uninterrupted power supply systems are useful in preventing such problems, but equipment manufacturers have clamored for high-performance power supplies capable of performing multifunctional simulations. This is because they need to carry out a wide range of power supply environmental tests such as voltage variation, power failure, and other tests.

Here, we give an overview of various regulated AC power supplies, focusing on differences in performance and intended applications.

4-1.Types of the regulated AC power supplies

● AC stabilizers (AVR)
- Saturable reactor system
- Ferroresonance system
- Autotransformer system
- Tap switching system
- Phase control system
- Linear amplifier system (voltage correction system)

● Frequency converters (CVCF)
- Linear amplifier system
- Inverter system

Various other systems are available, aside from those above, but for the most part, these have not yet been put to practical use or lack suitable examples of application. We also omit discussions of saturable reactor and ferroresonance systems, since they are now seldom-used.

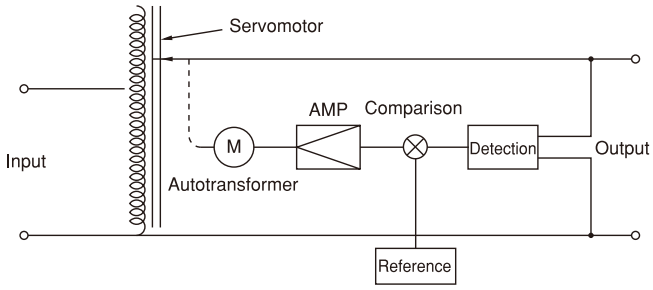
■ Basic principles of power supplies

4-2.AC stabilizers (AVR)

1.Autotransformer system

In such systems, an autotransformer is inserted between the input and output sides. The system detects the output voltage of the autotransformer, converts it into a DC signal to be compared with the reference voltage (DC), and power-amplifies the difference between them. The error signal is then supplied to the autotransformer and the servomotor, which regulates for constant output voltage by moving the slider. Such a system offers efficiency, compact size, and low cost but are slow response, due to the reliance on mechanical action, low reliability due to the relatively short service life of the slider, and output voltage distortion almost equal to that of input voltage. [Fig. 13]

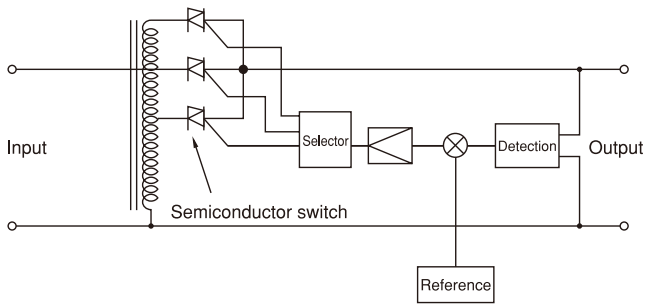
[Fig. 13] Autotransformer System



2.Tap switching system

In tap switching systems, a transformer with a number of taps is inserted between the input and output side. The system detects the output voltage of the transformer, compares it to a reference voltage, and amplifies the difference. To maintain constant output voltage, it then switches the tap voltage of the transformer based on the error signal using semiconductor switches, such as thyristors and Triac. Since it involves no mechanical actions, this system has a longer service life than autotransformer systems, and offers good efficiency, compact size, and low cost [Fig. 14] .

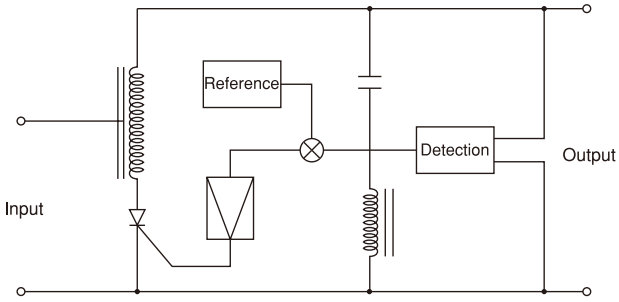
[Fig. 14] Tap Switching System



3.Phase control system

This system controls input power using an SCR or other device to obtain power, which is then passed through a low-pass filter configured by an LC resonance or other circuit type for waveform shaping and output as a sine wave. As with autotransformer systems, control of output voltage is achieved by comparing DC signals. Response speed is relatively slow, due to the time constant of the AC/DC signal converter. This system can also achieve good efficiency, relatively compact size, and low cost. It offers high reliability, but produces large distortion. [Fig. 15]

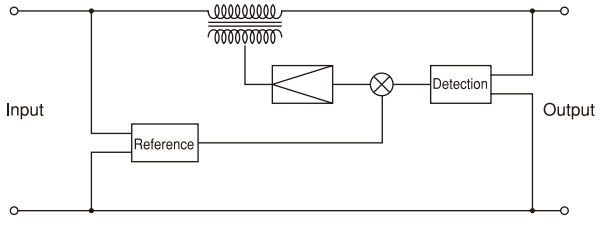
[Fig. 15] Phase Control System



4.Linear amplifier system (voltage correction system)

To achieve constant output voltage (waveform), this system uses a linear amplifier to correct changes in input voltage (waveform). It generates a reference voltage (sine wave) synchronized with the input power to compare an output voltage detection signal with the reference voltage, power-amplifies the difference using a linear amplifier, and instantaneously corrects the voltage waveform based on the amplified error signal using the transformer inserted in series between the input and output sides. The system features stable output voltage and superior output waveform quality, including low distortion but it is slightly less efficient and more costly. [Fig. 16]

[Fig. 16] Linear Amplifier System (AVR)



■ Basic principles of power supplies

4-3.Frequency converters (CVCF)

1.Linear amplifier system

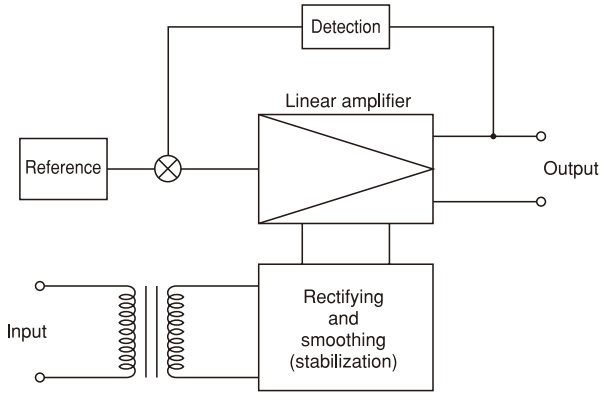
This system converts input power into DC power using a rectifier circuit to supply the DC power as power for a linear amplifier. It also produces a reference sine wave voltage from a crystal oscillator or similar device and power-amplifies it as input for the linear amplifier for output. [Fig. 17]

Because the efficiency of the linear amplifier depends significantly on the DC power voltage supplied, the linear amplifier uses a phase-control circuit or switching power supply circuit for stabilization. A transformer is often installed on the input or output side to obtain an appropriate supply voltage and to isolate the input and output sides. The quality of the output waveform is determined by the location of this inserted transformer.

Since the use of an output transformer degrades frequency characteristics and characteristics such as stability and distortion, the output transformerless (OTL) system would remove the transformer from the feedback loop. Such a system would solve the problem of output transformer saturation, allowing output voltage and frequency to be changed at any timing. This permits power lines to be tested for abnormal circumstances, including simulations of instantaneous power failure, and makes possible the use of linear amplifier systems with ATE and other equipment.

Moreover, extending the frequency characteristics of the linear amplifier permits simulations that closely resemble the actual behavior of commercial power lines in distorted waveform and other characteristics. The linear amplifier system offers considerable future potential.

[Fig. 17] Linear Amplifier System (Frequency Converter)



2.Inverter system

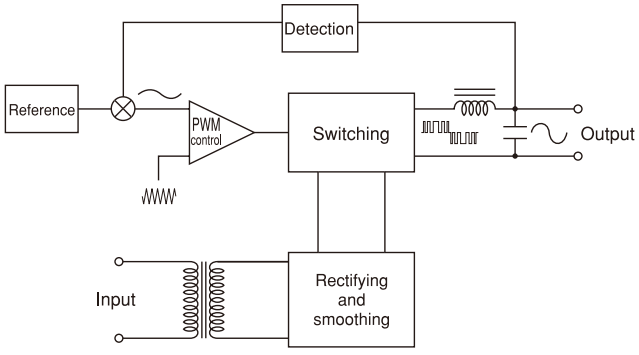
This system uses a DC/AC inverter of the PWM (pulse width modulation) switching system, instead of the linear amplifier described. The inverter offers outstanding efficiency [Fig. 18] The system has little dependency on the input power, making regulation of the input power unnecessary. If the input and output sides do not need to be isolated, the transformer can also be omitted from the circuit.

Such a system offers compact size and high efficiency, but the output voltage quality is inferior to that of linear amplifier systems. It also generates relatively high noise levels.

However, advances in semiconductor technology have made conversion to high frequency easier, and helped to improve the quality of the output voltage. The inverter system is the best-regulated AC power supply for energy conservation.

This system is already in mainstream use for the DC-AC converter in uninterrupted power supply systems and for the inverter air-conditioning equipment.

[Fig. 18] Inverter System



■ On Hipot tests and insulation resistance tests involving electrical or electronic equipment

[Remarks]

- This Q&A guideline is primarily based on the present domestic situation in Japan. Therefore, please be advised that, when used outside Japan, part of its content should be changed as appropriate for the relevant regulations or standards in effect in the country concerned.
- While every effort has been made to ensure the accuracy of the technical information contained herein, Kikusui Electronics Corp. shall have no liability with respect to any inconvenience or failure caused by reliance on the technical information contained herein.
- The technical information contained herein is subject to change without notice.
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Q1 What is the Hipot test?

The Hipot test is intended to verify whether an electrical product or part has sufficient dielectric strength to withstand the voltage it is expected to handle (whether it will not suffer a dielectric breakdown).
All electrical products should be safe to use. Under no circumstances should they put users' lives at risk nor damage their assets. The safety of home electrical appliances and other similar devices used by non-technical users is of particular importance. Users of such products should be protected against electric shock, injury, fire, explosion, and other potential dangers. Of the safety factors regarding electrical products, protection against electric shock and fire is especially vital. An electrical product is composed of a large number of parts, which can roughly be divided into those that allow the passage of electric current (conductors) and those intended to prevent it (insulators). If any of the insulators used in a product is defective, there is a danger that the user may experience an electric shock upon contact with the product. Also, if the heat builds up in the defective insulator, it is possible that a fire will break out. Tests meant to prevent such accidents include a Hipot test, insulation resistance test, and leakage current test, which are conducted between any primary circuit connected to the commercial power line and any conductive part of an electrical product (body, cabinet, etc.) that can potentially come into contact with the human body. A ground continuity test may also be included in the case of a three-wire AC input device.
To meet the purpose mentioned above, the safety standards in many countries require that manufacturers of electrical products include the Hipot test in their testing process and conduct it in combination of one to three of the other tests. A number of safety standards make it mandatory to perform the Hipot test not only during the type inspection intended to verify the safety of the product design but also during the 100 percent inspection in the final process aimed at verifying that all finished products are safe. As indicated by these facts, the Hipot test is deemed to be the fundamental test for ensuring the safety of an electrical product. As evident from the fact that the Hipot test is also referred to as a dielectric strength test, the purpose of this test is to verify whether an electrical product or part has sufficient dielectric strength to withstand the voltage it is expected to handle. In other words, it is intended to find defective products or parts that are suffering or can suffer a dielectric breakdown.
The test method is to expose the insulating material under test to an AC or DC voltage of a specified magnitude, typically 10 to 20 times greater than the voltage that the product normally handles, for a specified duration of time. If no dielectric breakdown (no sudden increase in current inconsistent with Ohm's law) occurs, that insulating material is judged to have sufficient dielectric strength.
The Hipot test is intended to verify whether an electrical product or part has sufficient dielectric strength to withstand the voltage it is expected to handle (whether it will not suffer a dielectric breakdown). If proven to have sufficient dielectric strength, the product or part is considered to meet the requirements for protection against electric shock and fire.

Q2 What is the difference between the insulation resistance test and the Hipot test?

The insulation resistance test is similar to the Hipot test in that its purpose is to verify that the product meets the requirements for protection against electric shock and fire, as well as to check the functionality or performance of the insulation system.
The two tests are different, however, in that the Hipot test detects an insulation defect by checking whether no dielectric breakdown occurs, while the insulation resistance test does so by measuring resistance.
The test method is to apply a DC voltage of a specified magnitude, typically 5 to 10 times greater than the voltage that the product normally handles, for a specified duration of time after moisture absorption (which may be omitted in some cases). If proven to have sufficiently large resistance, the product is considered to meet the requirements for protection against electric shock and fire.
Many safety standards regard the insulation resistance test as part of the type inspection and state that it may be omitted from the 100 percent inspection on the production line.

Q3 Why is the Hipot test necessary?

All electrical products should be safe to use.
Under no circumstances should they put users' lives at risk nor damage their assets. That is why we have safety standards both at home and abroad.
The Hipot test is intended to verify that no dielectric breakdown will occur in a product; in other words, the test is necessary to ensure that the product under test is safe to use.
For this reason, every manufacturer of electrical products is obliged to perform the Hipot test as part of their inspection process, regardless of whether they have an intention to comply with specific safety standards.

■ On Hipot tests and insulation resistance tests involving electrical or electronic equipment

Q4 Do I need to use the Hipot tester to perform the Hipot test?

Every safety standard specifies the requirements (method) of the Hipot testing. (Some standards may include requirements regarding a tester to be used.) Therefore, as long as you can perform the Hipot test in a way that meets all specified requirements, you do not necessarily need to use a Hipot tester.
One thing to note, however, is that the Hipot tester is specifically designed to ensure the safety of the operator during the course of a Hipot test. We therefore recommend using a Hipot tester where possible.
For example, Electrical Appliance and Material Safety Law (in Japan), specifies that the dielectric strength testing facilities for home electrical appliances, such as washing machines, refrigerators, and television sets, shall:
(1) Be equipped with a transformer, voltage regulator, and voltmeter (with accuracy of class 1.5 or above) or a dielectric strength tester with such devices built into it.
(2) Have the ability to adjust the secondary voltage easily and smoothly to the dielectric strength test voltage.
As suggested by this law, the use of the Hipot tester is not necessarily required.

Q5 If the Hipot tester is capable of DC output , how do I use the DC Hipot tester and the AC Hipot tester?

The Hipot test is basically performed with an AC voltage.
In some cases, however, the AC Hipot testing may cause a large current to flow to the noise filter or other capacitive component, adversely affecting the test. Some safety standards permit the DC Hipot testing to be conducted in place of the AC Hipot testing where appropriate.
Many of such standards specify that the DC test voltage should be equal to the peak value of the specified AC test voltage.
Note that some safety standards require that the DC Hipot testing be performed when testing a DC circuit.

Q6 Why is a DC voltage used for the insulation resistance test?

The insulation resistance test detects an insulation defect by measuring the resistance of the device under test.
A DC voltage is used because it is more convenient for measuring only the resistance component.

Q7 Due to poor (commercial) power supply conditions in my workplace, the Hipot tester outputs distorted waveforms. What do the typical standards say about waveform skew?

Most safety standards specify that the test voltage waveform should be a "sine waveform." It is generally said that sinusoidal waves having a distortion factor not greater than 5 % may be called sine waveforms.
Also, some safety standards (e.g., UL1492 "Audio-Video Products and Accessories") define the requirements regarding the test waveform, as follows:
"The test waveform shall be a sine waveform within the frequency range between 40 Hz and 70 Hz, and its peak value shall be at least 1.3 times but not greater than 1.5 times of its RMS value."

Q8 Can I perform the Hipot test for a three-phase AC device without using a three-phase AC power supply?

It is not necessary to use a three-phase AC power supply.
The Hipot test is intended to verify that those conductive parts that can potentially come into contact with the human body are fully insulated from the live parts.
Therefore, the test is conducted between the primary power line and the conductive parts that may come into direct contact, regardless of the structure of the device under test.

Q9 At my workplace, the Hipot test is performed by applying a 1200-volt voltage for one second, instead of a 1000-vol for one minute, for the benefit of improved productivity. Is this a proper way to conduct a Hipot test?

Some standards permit the production line Hipot testing to be conducted in the manner described above. So, your idea is not off the mark.
Generally, the Hipot test checks that no dielectric breakdown occurs, by applying a specified voltage for a specified duration of time. This is possible because degradation in the insulating material can be treated as functions of voltage and time. In some cases, therefore, the safety standard may allow the Hipot test to be performed by applying a higher voltage for a shorter duration of time.
For example, a number of safety standards state that the duration of the production line Hipot test may be reduced to one second in order to improve productivity on condition that a voltage as high as 6/5 of the voltage specified for the one-minute test is applied.
Note, however, that the actual requirements may differ for various safety standards; it is necessary to check ensuring the standard concerns.

■ On Hipot tests and insulation resistance tests involving electrical or electronic equipment

Q10 Is there any specific rule of performing the Hipot test and the insulation resistance test?

Some safety standards stipulate that the Hipot test and the insulation resistance test should be conducted in a specified order. Where such an order is defined, an insulation resistance test often tends to be performed first.
Some standards do not require the insulation resistance test.

Q11 What is a leakage current?

Generally, a current flow that is induced when a voltage is applied to an insulating material (insulator) is called a leakage current. Therefore, any currents that flow through the insulator during the Hipot test, insulation resistance test, or line leakage current test are all referred to as leakage currents. However, the international standard IEC60990: 1999-08 for leakage current measurement methods does not specify the term of "leakage current." It uses the terms of "touch current" and "protective conductor current." instead. So the formal name of the standard is "Methods of measurement of touch current and protective conductor current." In any of these tests, the insulator is considered to be of poor performance if a leakage current flows through it. Naturally, the higher the leakage current becomes a subject of, the greater the risk of electric shock or fire.

Q12 The Hipot tester I use has a label attached showing when it was last calibrated. What does it mean?

The-calibration is to compare the indicated value on a measuring instrument against the true value.
A measuring instrument serves its purpose only if it produces an accurate reading. One familiar example is a weighing scale. The act of determining the value to be given to a measuring instrument is referred to as calibration. Every electrical measuring instrument has error. The instrument needs to be adjusted if its indicated value is outside the margin of error defined in its specification. Generally, the whole process, including this adjustment, is sometimes called calibration.
If you send in a measuring instrument for us to calibrate, we will adjust the instrument so that it operates within its specification and return the calibrated instrument to you along with its calibration data (test sheet), with a "calibration label" showing the date of calibration attached on the instrument.
There is no specific rule as to how often to calibrate a measuring instrument. Customers who ask us to perform calibration for them typically want to have their instruments calibrated at intervals of 6 or 12 months.

Q13 My company has never had its Hipot tester calibrated. It was pointed out during an audit we had the other day. Is there any quick, simple way to conduct calibration?

If you purchase a high-voltage voltmeter or current calibrator for calibrating the output voltage of our Hipot tester, it will be possible to compare the indicated value on the tester against the true value.
However, please note that the tester generates a high voltage and its calibration involves a substantial danger. Also, in order to perform calibration properly, the calibrator must have a higher accuracy than the instrument it calibrates.
We therefore would like you to contact our distributor from which you purchased the tester and they will arrange to conduct the calibration for you.

Q14 Is there any official calibration method (that is compliant with the relevant national standards)?

Our calibration service handles to customers' needs to calibrate their instruments they purchased from us. Contact us or the distributor from which you purchased the instrument.
We carry out calibration according to work procedures. The measuring instruments we use are traced to Japanese national standards (the independent administrative agency National Institute of Advanced Industrial Science and Technology or National Institute of Information and Communications Technology) or the international standards of foreign countries that are members of the International Committee of Weights and Measures, such as NPL (National Physical Laboratory) and NIST (National Institute of Standards and Technology), via JEMIC (Japan Electric Meters Inspection Corporation), JQA (Japan Quality Assurance Organization), or a calibration business (for example the manufacturer of the relevant measuring instrument).

Q15 Can I perform the calibration myself? To do so, what kind of qualification do I need? What kind of facility is required?

To conduct calibration requires adequate facilities, data entry forms, and skilled technicians.
The calibrator must have a higher accuracy than the instrument it calibrates, and its measurements must be connected to the national standards to maintain traceability. The data entry form must describe which values to enter and the range within which those values are to be controlled. Calibration technicians must have a full understanding of the proper calibration method and must be well versed with the instrument to be calibrated.
While no specific qualification is needed to perform calibration, calibrating an instrument involves a substantial danger. We therefore advise you to ask our distributer to do calibration for you.

■ On Hipot tests and insulation resistance tests involving electrical or electronic equipment

Q16 Does the tester require any pre-test inspection? If so, what should I do?

A pre-test inspection is necessary.
At least, you should check every aspect of the tester that ensure the safety of the operator, including whether the tester is properly grounded and whether the outer sheath of the high voltage test lead is free of cracks and tears.
Also, conduct a test by short-circuiting the high-voltage end of the test lead to the low-voltage end and check that the test result is unsuccessful. This test allows you to do a rough check on the tester's operability and whether there is no break in the test lead.
You also may want to prepare a model that will pass the test and one that will fail and, during the pre-test inspection, check that the tester accepts and rejects these models correctly. This will render your tests more reliable. To do so, build a resistance equivalent to a current slightly lower than the threshold value into the model that will pass the test, and a resistance equivalent to a current slightly higher than the threshold value into the model that will fail the test.
Or, you could purchase a high-voltage voltmeter or current calibrator for calibrating the output voltage of our Hipot tester. Conducting a check using such a device in the pre-test inspection would get you fully prepared for the testing activity.

Q17 I am instructed to check the test lead for breaks during the daily pre-test recommendation to do this other than short-circuiting the ends of the test lead?

One safe method to do this check is by turning off the power of the Hipot tester and then conducting the continuity test on each test lead using a multimeter or other appropriate tool.
If your tester has a lower judgement function, and if the flowing current drops below the tester's lower limit threshold when a current exceeding that threshold flows through the device under test, thus breaking the test lead, you can check for lead breaks, including poor contacts, by using this function.

Q18 Is there any easy way to check the daily pre-test inspection that the tester is ready to function properly?

One convenient way is to prepare the reference model that will pass the test and one that will fail and, during the pre-test inspection, check that the tester accepts and rejects these models correctly.
To do so, build a resistance equivalent to a current slightly lower than the threshold value into the reference model that will pass the test, and a resistance equivalent to a current slightly higher than the threshold value into the reference model that will fail the test.
Another way is to purchase a current calibrator for our Hipot tester and use this calibrator to check the tester during the pre-test inspection.

Q19 I am aware that the Hipot testing is a dangerous task and therefore I get very nervous whenever I do it. Tell me about an ideal working environment so that I won't have to worry any more.

It is vital to use a regularly calibrated tester properly within its specification, thoroughly read the operational instructions given in the accompanying manual to understand what is dangerous, and take all necessary precautions against potential accidents before operating the tester. In particular, be sure to:
(1) Wear a pair of rubber gloves to prevent an electric shock;
(2) Ground the tester to the earth; and
(3) Avoid touching the test lead while the tester is outputting a high voltage.
These three precautions are critically important and must be implemented whenever using the tester.
In addition, use an interlock function whenever possible if it is provided for a tester you are using. If the interlock trips, it places the tester in protected state to shut out the output of the tester, thus preventing the tester from being used for test. Once the interlock has tripped, the STOP switch on the tester panel or a STOP signal from a remote unit cannot reset it. Given below are some examples describing how to use interlocks:
- Provide a unit under test with a cover to prevent an electric shock, and use an interlock to allow power to be supplied to the unit when the cover is closed and to make sure to keep the power shut off while the cover is open.
- Surround a test site with a fence or the like, and use an interlock to allow power to be supplied to the site when the fence is closed and to keep the power shut off while the fence is open.
An ideal working environment is one in which thorough safety measures are taken to ensure safety and control.

Q20 What kind of qualification do I need to operate the Hipot tester?

No specific qualification is required to operate the Hipot tester.
Before operating the tester, however, you need to thoroughly read the operational instructions given in the accompanying manual to understand what is dangerous and take all necessary precautions against potential accidents.

■ On Hipot tests and insulation resistance tests involving electrical or electronic equipment

Q21 What is the "zero-turn-on switch"?

The zero-turn-on switch is a switch device that is controlled so that the test voltage output switch closes when the voltage nears 0 V during the AC Hipot test.
If you let the switch close without such a control mechanism, the output voltage will fluctuate drastically, possibly resulting in higher voltages than the specified value. This can cause the tester to mistakenly reject acceptable products or damage the device under test, and making you unable to conduct the Hipot testing in a highly reliable manner.

Q22 What should I be careful about when I use a test lead other than the one that comes with the tester?

Do not use any test lead other than those that are officially provided from us. The accompanying test lead that comes with the product is made of material having sufficient dielectric strength to withstand the maximum output voltage of the tester you purchased and has a structure designed with safety in mind. It also has other features that ensure the reliability of the test.
If you have any problems with the accompanying test lead, please contact us.

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