P A T - T S E R I E S

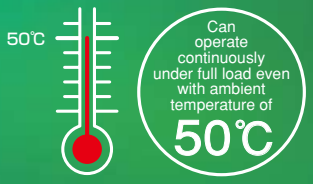
High-Efficiency, Large-Capacity Switching Power Supply
PAT-T Series

8 kW type (eleven models) and 4 kW type (four models): fifteen models in total.
Capable of operating continuously under full load even with an ambient temperature of 50°C.
Up to five units can be operated in parallel (40 kW).
Equipped with power factor correction circuit.
High noise resistance.
Standardly equipped with RS-232C interface equipped as standard.
USB, GPIB, and LAN interfaces available (factory option).
LAN interface applies to LXI

KIKUSUI

Tough & Eco

Large-capacity, yet compact and tough. Large-capacity power supply that is environmentally friendly.



【Guaranteed operating temperature】

550 (620) mm

129.2 (155) mm

*Maximum dimension appears in parentheses ( ).

430 (440) mm

Weight: Approx. 25 kg (PAT40-200T)

High-Efficiency, Large-Capacity Switching Power Supply

PAT-T series

Maximum power output 8kW [8kW type]

Two types, with rated power outputs of 8 kW and 4 kW: nine models in total.

Outline

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 greatly reduce the size and weight of the unit. It features an exceptional “power factor correction circuit” for its class, and improves the power supply environment (suppresses harmonic currents). It also greatly contributes to "energy saving," as exemplified by its simplified and miniaturized power reception and distribution modules, and lower power consumption. Furthermore, an optimized heat radiation design makes operation guaranteed at ambient temperatures of up to 50°C. It can thus be deployed in demanding usage environments where it must provide full-load, continuous operation despite high ambient temperatures.

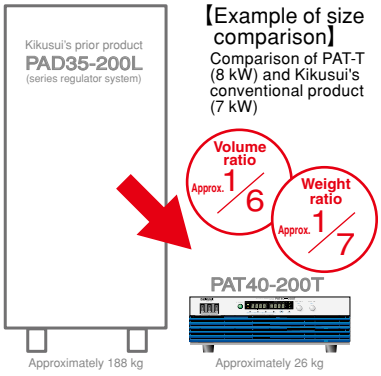
Lineup

Rated Power	Model	Rated Voltage	Rated Current
8 kW	PAT20-400T*	0 V-20 V	0 A-400 A
	PAT30-266T	0 V-30 V	0 A-266 A
	PAT40-200T*	0 V-40 V	0 A-200 A
	PAT60-133T*	0 V-60 V	0 A-133 A
	PAT80-100T	0 V-80 V	0 A-100 A
	PAT160-50T*	0 V-160 V	0 A-50 A
	PAT250-32T* NEW	0 V-250 V	0 A-32 A
	PAT350-22.8T* NEW	0 V-350 V	0 A-22.8 A
	PAT500-16T* NEW	0 V-500 V	0 A-16 A
	PAT650-12.3T*	0 V-650 V	0 A-12.3 A
	PAT850-9.4T* NEW	0 V-850 V	0 A-9.4 A
4 kW	PAT20-200T	0 V-20 V	0 A-200 A
	PAT40-100T	0 V-40 V	0 A-100 A
	PAT60-67T	0 V-60 V	0 A-67 A
	PAT160-25T	0 V-160 V	0 A-25 A

*For those models with ⋆ mark, 3-phase 400V input is available.

Large capacity yet compact!

Neatly fits into smaller spaces!



Can use vertically, too! (Optional)

Easy to carry and can use on test table side.

Compatible with all PAT-T series models.
Comes with caster-equipped frame and handle kit.

Option

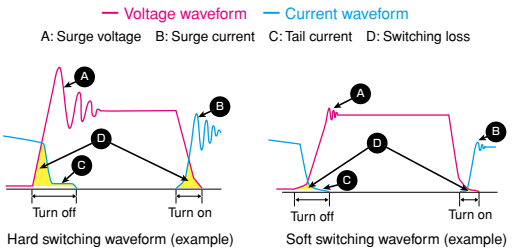
■Vertical stand

*PAT-T series main unit is not included.

Offers compactness, high efficiency, and energy saving!

Soft switching system

This power supply circuit system skillfully utilizes resonance to execute power device switching when the voltage or current is zero. Thus, in principle, the unit can operate without switching loss and without transient crossover of voltage and current. In general, switching that occurs when voltage is zero is called zero voltage switching (ZVS), while switching that occurs when current is zero is called zero current switching (ZCS). With conventional power supply circuits, problems such as increasing power loss and diminishing efficiency occur when switching operations increase in speed. A soft switching system, however, features a high-efficiency power supply circuit that reduces heat loss generated from the power supply and enables the miniaturization of circuits, not only making it possible to miniaturize equipment but to considerably minimize noise generated from the power supply.

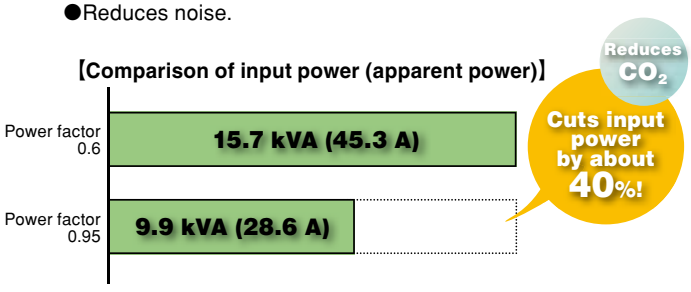


Power factor correction circuit

The power factor (PF) is a value that indicates the efficiency of an alternating current circuit, and it refers to the ratio of the effective power to the apparent power. The closer the power factor is to 1, the better will be the efficiency of electric power energy usage in the equipment (circuit). Incorporating a power factor correction circuit into a power circuit's input unit will correct AC voltage and current phase differences (waveform deviations cause reactive power), and improve the efficiency of electric power usage. Specific advantages include the following:

- ●Promotes energy saving.
- ●Downsizes power reception and distribution equipment.
- ●Improves the power supply environment.
- ●Reduces transmission loss.
- ●Reduces noise.

【Comparison of input power (apparent power)】

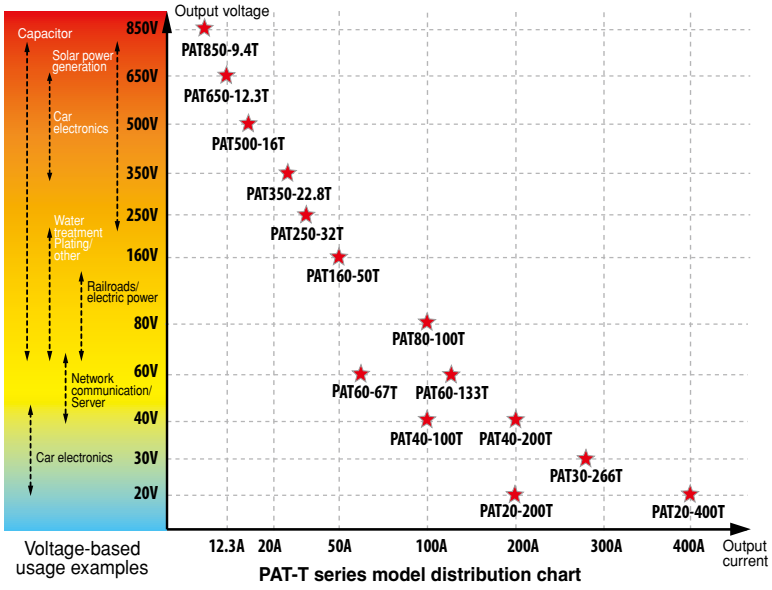


The above values apply when DC-power, full-load operation is performed with an output of 40 V and 200 A, and an efficiency of 85%.
*Values appearing in parentheses ( ) are electric current values for each phase with three-phase, 200 volt input.

Improving the power factor from 0.6 to 0.95 reduces the required input power by about 40%. Thus, a high power factor **saves energy!**

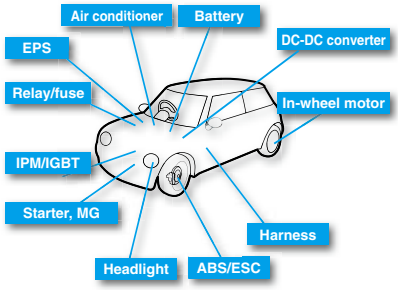
Purpose and Application Examples/Various Functions

The output voltage lineup ranges from 20 V to 850 V. The product can be used as a power supply for various evaluations and tests.



【Car electronics applications】

- Lifetime testing of headlights
- Performance and endurance testing of inverters for use in high-capacity air conditioners and motors
- Performance and endurance testing of brushless motors for use in EPS and MG units
- Performance testing of IPM, IGBT, and other power modules
- Performance testing of starter motors
- Performance testing of EV/HEV electrical components

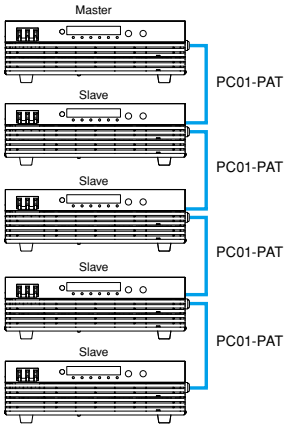


More convenient, easier to use, and safer

- 4 kW type can operate even with single-phase 200 volt input. (However, current is limited to about 75% of rated value.)
- Standardly equipped with RS-232C interface.
- Supports USB/GPIB/LAN interface. (Factory option)
- Controllable from Excel VBA and LabView with measuring instrument driver. Driver can be downloaded free at our web site.
- Capacity can be expanded through parallel operation (up to five units of the same model).
- Equipped with reliable output ON/OFF delay function during sequence operations.
- Memory function (three sets of voltage/current)
- Voltage/current monitor output
- Status signal output
- Remote sensing function
- Protective functions (shutdown, as well as protection against overvoltage, overcurrent, overheating, input phase interruption, fan malfunction, sensing, and bleeder circuit overheating)
- High noise resistance (for reassurance during car electronics testing)
- Good maintainability, including easy fan replacement

Up to five units (of the same model) possible

Up to five units, including the master unit, can be connected in parallel. Parallel operation is enabled using parallel operation cable (optional).



Smart rack system

This large-current model assembles multiple PAT-T seriesunits with special rack parts.
Five types are available, with rated voltages of 20, 40, 60, 160, and 650 volts.
A total of forty models are available, ranging from 16 kW to 40 kW.

Model with breaker

Model without breaker

* About the smart rack system, please consult us.

8 kW Type Specifications

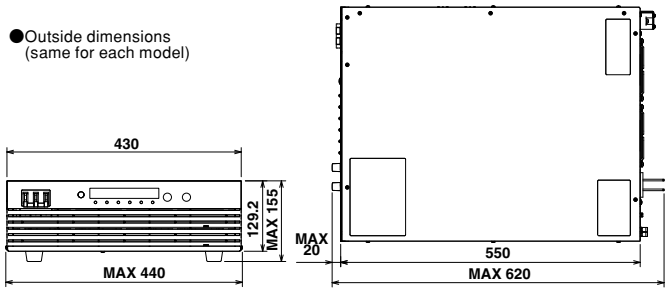
Item			PAT20-400T	PAT30-266T	PAT40-200T	PAT60-133T	PAT80-100T
Input	Nominal input rated voltage		Three-phase 200 to 240 VAC, 50-60 Hz				
	Input voltage range/Input frequency range		180 V to 250 V / 47Hz to 63 Hz				
	Efficiency		85% (min) [at input voltage of 200 VAC and rated load]				
	Power factor		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		10kVA (max)				
Output	Rating	Rated output power	8 kW				
		Rated output voltage	20.00 V	30.00 V	40.00 V	60.0 V	80.0 V
		Rated output current	400.0 A	266.0 A	200.0 A	133.0 A	100.0 A
	Constant voltage	Setting accuracy	± (0.2% of rating +50 mV)				
		Max setting voltage	105% of rating				
		Line requlation	± (0.05% of rating +5 mV)				
		Load requlation	± (0.1% of rating +5 mV)				
		Transient response time	5 ms (at an instantaneous change in the load current from 50% to 100%)				
		Ripple noise	100 mVp-p	300 mVp-p	300 mVp-p	350 mVp-p	350 mVp-p
			When the measurement frequency band is 10 Hz to 20 MHz				
			10 mVrms	20 mVrms	30 mVrms	30 mVrms	30 mVrms
			When the measurement frequency band is 5 Hz to 1 MHz				
		Raise time	100 ms (rated load)/100 ms (no load)				
		Fall time	100 ms (rated load)/2000 ms (no load)				
		Temperature coefficient	100 ppm/˚C (max) [with external analog control]				
	Constant current	Setting accuracy	± (0.5% of rating +50 mA)				
		Max setting current	105% of rating				
		Line requlation	± (0.1% of rating +30 mA)				
		Load requlation	± (0.2% of rating +30 mA)				
		Ripple noise	500 mArms	400 mArms	400 mArms	350 mArms	300 mArms
			When the measurement frequency band is 5 Hz to 1 MHz				
		Temperature coefficient	200 ppm/˚C (typ) [with external analog control]				
	OUTPUT ON/OFF delay		OFF. 0.1 to 10.0 s (resolution: 0.1 s)				
Voltage display		Maximum display	99.99				
		Error	± (0.2% of reading +5 digits) at 23˚C ±5˚C				
Current display		Maximum display	999.9				
		Error	± (0.5% of reading +5 digits) at 23˚C ±5˚C				
Protection function			Overvoltage protection (OVP) / Overcurrent protection (OCP) / Overheat protection (OHP) / Input open phase protection (PHASE) / Fan error protection (FAN) / Mis-connection protection (SENSE) / Breeder circuit overheat protection (BOHP) / Shutdown (SD)				
External analog control		OUTPUT ON/OFF control, etc.	OUTPUT ON/OFF, SHUTDOWN				
		Constant voltage, external voltage control	0% to 100% of the rated output voltage at 0 to 10 V				
		Constant voltage, external resistance control	0% to 100% or 100% to 0% of the rated output voltage at 0 Ω to 10 kΩ				
		Constant current, external voltage control	0% to 100% of tared output current at 0 to 10 V				
		Constant current, external resistance control	0% to 100% or 100% to 0% of rated output currenn at 0 Ω to 10 kΩ				
Monitor output		Output voltage	10.00 V ±0.25 V at rated voltage output				
			0.00 V ±0.25 V at 0 V output				
		Output current	10.00 V ±0.25 V at rated current output				
			0.00 V ±0.25 V at 0 A current				
Status output			OUT ON, CV, CC, ALARM, POWER ON, POWER OFF, insulated open collector				
Remote control			Equipped with RS-232C interface as standard. SCPI commands, up to 38,400 bps				
Operating temperature/humidity range			0˚C to 50˚C, 20% to 85% rh				
Storage temperature/humidity range			-25˚C to 70˚C, 90% rh or less (non-condensing)				
Dimensions (maximum)			430 (440) W × 129.2 (155) H × 550 (620) D mm				
Weight			Approx. 26 kg	Approx. 27 kg	Approx. 25 kg	Approx. 24 kg	

8 kW Type Specifications

Item			PAT160-50T	PAT250-32T	PAT350-22.8T	PAT500-16T	PAT650-12.3T	PAT850-9.4T
Input	Nominal input rated voltage		Three-phase 200 to 240 VAC, 50-60 Hz					
	Input voltage range/Input frequency range		180 V to 250 V / 47Hz 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		10kVA (max)					
Output	Rating	Rated output power	8 kW					
		Rated output voltage	160.0 V	250.0 V	350.0 V	500.0 V	650.0 V	850.0 V
		Rated output current	50.0 A	32.0 A	22.8 A	16.0 A	12.3 A	9.4 A
	Constant voltage	Setting accuracy	± (0.2% of rating +50 mV)					
		Max setting voltage	105% of rating					
		Line requlation	± (0.05% of rating +5 mV)					
		Load requlation	± (0.1% of rating +5 mV)					
		Transient response time	5 ms (at an instantaneous change in the load current from 50% to 100%)					
		Ripple noise	350 mVp-p	450 mVp-p	450 mVp-p	600 mVp-p	600 mVp-p	600 mVp-p
			When the measurement frequency band is 10 Hz to 20 MHz					
			30 mVrms	50 mVrms	50 mVrms	100 mVrms	100 mVrms	100 mVrms
			When the measurement frequency band is 5 Hz to 1 MHz					
		Raise time	100 ms (rated load)/100 ms (no load)					
		Fall time	100 ms (rated load)/2000 ms (no load)		200 ms (rated load)/ 4000 ms (no load)			
		Temperature coefficient	100 ppm/˚C (max) [with external analog control]					
	Constant current	Setting accuracy	± (0.5% of rating +50 mA)				± (1% of rating +100 mA)	
		Max setting current	105% of rating					
		Line requlation	± (0.1% of rating +30 mA)					
		Load requlation	± (0.2% of rating +30 mA)					
		Ripple noise	200 mArms	200 mArms	200 mArms	200 mArms	150 mArms	120 mArms
			When the measurement frequency band is 5 Hz to 1 MHz					
		Temperature coefficient	200 ppm/˚C (typ) [with external analog control]					
	OUTPUT ON/OFF delay		OFF. 0.1 to 10.0 s (resolution: 0.1 s)					
Voltage display		Maximum display	999.9					
		Error	± (0.2% of reading +5 digits) at 23˚C ±5˚C					
Current display		Maximum display	999.9	99.99				
		Error	± (0.5% of reading +5 digits) at 23˚C ±5˚C					
Protection function			Overvoltage protection (OVP) / Overcurrent protection (OCP) / Overheat protection (OHP) / Input open phase protection (PHASE) / Fan error protection (FAN) / Mis-connection protection (SENSE) / Breeder circuit overheat protection (BOHP) / Shutdown (SD)					
External analog control		OUTPUT ON/OFF control, etc.	OUTPUT ON/OFF, SHUTDOWN					
		Constant voltage, external voltage control	0% to 100% of the rated output voltage at 0 to 10 V					
		Constant voltage, external resistance control	0% to 100% or 100% to 0% of the rated output voltage at 0 Ω to 10 kΩ					
		Constant current, external voltage control	0% to 100% of tared output current at 0 to 10 V					
		Constant current, external resistance control	0% to 100% or 100% to 0% of rated output currenn at 0 Ω to 10 kΩ					
Monitor output		Output voltage	10.00 V ±0.25 V at rated voltage output					
			0.00 V ±0.25 V at 0 V output					
		Output current	10.00 V ±0.25 V at rated current output					
			0.00 V ±0.25 V at 0 A current					
Status output			OUT ON, CV, CC, ALARM, POWER ON, POWER OFF, insulated open collector					
Remote control			Equipped with RS-232C interface as standard. SCPI commands, up to 38,400 bps					
Operating temperature/humidity range			0˚C to 50˚C, 20% to 85% rh					
Storage temperature/humidity range			-25˚C to 70˚C, 90% rh or less (non-condensing)					
Dimensions (maximum)			430 (440) W × 129.2 (155) H × 550 (620) D mm					
Weight			Approx. 24 kg	Approx. 23 kg			Approx. 22 kg	Approx. 23 kg

●Rear panel (8 kW type PAT40-200T rear panel example)

●Outside dimensions
(same for each model)



4 kW Type Specifications

Item			PAT20-200T	PAT40-100T	PAT60-67T	PAT160-25T
Input	Nominal input rated voltage		Single-phase/three-phase 200 to 240 VAC, 50-60 Hz			
	Input voltage range/Input frequency range		180 V to 250 V / 47 Hz to 63 Hz			
	Efficiency		84% (min)	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]			
Output	Rating	Rated output power	4 kW			
		Rated output voltage	20.00 V	40.00 V	60.00 V	160.0 V
		Rated output current	200.0 A	100.0 A	67.00 A	25.00 A
	Constant voltage	Setting accuracy	± (0.2% of rating +50 mV)			
		Max setting voltage	105% of rating			
		Line requlation	± (0.05% of rating +5 mV)			
		Load requlation	± (0.1% of rating +5 mV)			
		Transient response time	5 ms (at instantaneous change in load current from 50% to 100%)			
		Ripple noise	100 mVp-p	300m Vp-p	350 mVp-p	350 mVp-p
			When the measurement frequency band is 10 Hz to 20 MHz			
			10 mVrms	30 mVrms	30 mVrms	30 mVrms
			When the measurement frequency band is 5 Hz to 1 MHz			
		Raise time	100 ms (rated load)/100 ms (no load)			
		Fall time	100 ms (rated load)/2000 ms (no load)			
		Temperature coefficient	100 ppm/˚C (max) [with external analog control]			
	Constant current	Setting accuracy	± (0.5% of rating +50 mA)			
		Max setting current	105% of rating × 75% (with single-phase input) / 105% of rating (with three-phase input)			
		Line requlation	± (0.1% of rating +30 mA)			
		Load requlation	± (0.2% of rating +30 mA)			
		Ripple noise	400 mArms	300 mArms	250 mArms	200 mArms
			When the measurement frequency band is 5 Hz to 1 MHz			
		Temperature coefficient	200 ppm/˚C (typ) [with external analog control]			
	OUTPUT ON/OFF delay		OFF. 0.1 to 10.0 s (resolution: 0.1 s)			
Voltage display		Maximum display	99.99			999.9
		Error	± (0.2% of reading +5 digits) at 23˚C ±5˚C			
Current display		Maximum display	999.9		99.99	
		Error	± (0.5% of reading +5 digits) at 23˚C ±5˚C			
Protection function			Overvoltage protection (OVP) / Overcurrent protection (OCP) / Overheat protection (OHP) / Input open phase protection (PHASE) / Fan error protection (FAN) / Mis-connection protection (SENSE) / Breeder circuit overheat protection (BOHP) / Shutdown (SD)			
External analog control		OUTPUT ON/OFF control, etc.	OUTPUT ON/OFF, SHUTDOWN			
		Constant voltage, external voltage control	0% to 100% of the rated output voltage at 0 to 10 V			
		Constant voltage, external resistance control	0% to 100% or 100% to 0% of the rated output voltage at 0 Ω to 10 kΩ			
		Constant current, external voltage control	0% to 100% of tared output current at 0 to 10 V			
		Constant current, external resistance control	0% to 100% or 100% to 0% of rated output currenn at 0 Ω to 10 kΩ			
Monitor output		Output voltage	10.00 V ±0.25 V at rated voltage output			
			0.00 V ±0.25 V at 0 V output			
		Output current	10.00 V ±0.25 V at rated current output			
			0.00 V ±0.25 V at 0 A current			
Status output			OUT ON, CV, CC, ALARM, POWER ON, POWER OFF, insulated open collector			
Remote control			Equipped with RS-232C interface as standard. SCPI commands, up to 38,400 bps			
Operating temperature/humidity range			0˚C to 50˚C, 20% to 85% rh			
Storage temperature/humidity range			-25˚C to 70˚C, 90% rh or less (non-condensing)			
Dimensions (maximum)			430 (440) W × 129.2 (155) H × 550 (620) D mm			
Weight			Approx. 20 kg	Approx. 19 kg	Approx. 18 kg	

4 kW type can operate with single-phase 200 volt input.
However, current is limited to about 75% of rated value.

Communication Interface (Each Model is the Same)	
RS-232C	Conforms to EIA232D specifications. D-SUB 9-pin connector Baud rate: 1200, 2400, 4800, 9600, 19200, 38400 bps Data length: 7 or 8 bits, Stop bit length: 1 or 2 bits, Parity: None, flow control
GPIB※	Conforms to IEEE Std 488.1-1987 specifications. SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1
USB※	Conforms to USB2.0 specifications. Communication speed: 12 Mbps (full speed) Conforms to USBTMC-USB488 device class specifications.
LAN※	Conforms to the protocol VXI-11 IEEE 802.3 100Base-TX/10Base-T Ethernet IPv4, RJ-45 connector
Common	Conforms to the messaging protocol IEEE Std 488.2-1992, SCPI Specification 1999.0

* One of these will be attached to the power supply unit.

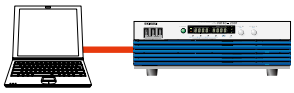
Note: An input power cable is not included with the PAT-T series. Customers should either provide an input cable themselves or request an input cable (AC8-4P4M-M6C) sold optionally by Kikusui.

Options

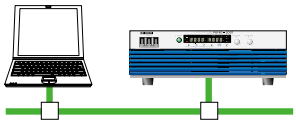
Communication interface (factory option) *

GPIB / USB / LAN

●RS-232C／GPIB／USB



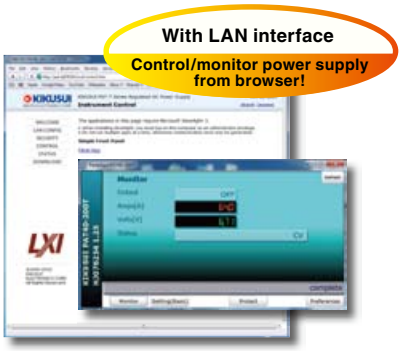
●LAN (Ethernet)



*One of these will be attached to the main power supply unit.

Command supports SCPI in addition to the IEEE 488.2 standard. Also, utilization of a measuring instrument driver (which can be downloaded at our web site) enables controlling with Excel VBA and LabView, and sequence control with "Wavy for PAT" sequence creation software is also possible. Furthermore, The LAN interface applies to the LXI(LAN eXtention for Instrumentation).

If a LAN interface is used, it is possible to control and monitor the power supply from a browser.



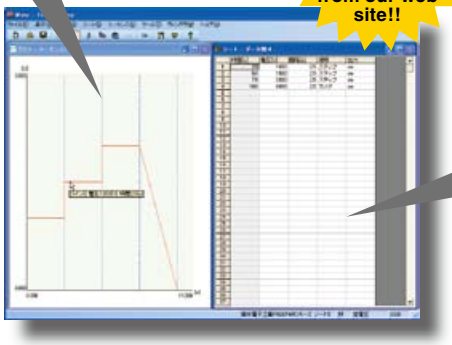
"Wavy" sequence creation software

Wavy for PAT-T

This software is used to support sequence creation and execution with a DC power supply. You can use the Wavy to create and edit sequenses with a mouse.

Creation of conditions
Sequence creation is possible by two methods: a mouse or numerical input.

A trial version can be downloaded from our web site!!



Test results
Results are saved in text format, and development is easy with spreadsheet software!!

- Makes it easy to create and edit test condition data required in sequence operations.
- A test condition data file saving function makes it easy to manage standard test conditions.
- Displays the progress of an execution sequence on an "execution graph" with setting values and a cursor.
- A "monitor graph" that plots monitored values during execution makes it possible to observe actual power output intuitively.
- Capable of saving acquired monitor data as test results.

【Operating environment】Windows 2000 / XP / Vista / 7

*See the Kikusui product catalog and web site for details.

Input power cable

●AC8-4P4M-M6C

(Three-phase, four-conductor, 8 mm^2, 4 m, M6)

Parallel operation cable

●PC01-PAT

(Flat cable: 250 mm)

Power switch guard

● OP01-PAT

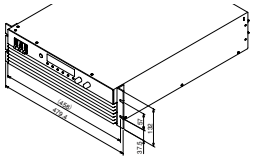
Vertical stand

● VS01

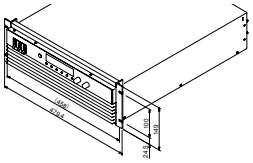
*PAT-T series main unit is not included.

Rack mount bracket

●KRB3-TOS (inch size)



●KRB150-TOS (millimeter size)



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