

PAS series

VARIABLE-SWITCHING REGULATED DC POWER SUPPLIES (CV-CC)

NEW



**Constant voltage/constant current
three types of 350 W, 700 W, and 1000 W, 15 models
with digital communication functions and a power-factor correction circuit**

Outline

The PAS Series consists of sophisticated variable-switching DC power supplies that refine and add to the advances of our conventional PAK-A Series. While the cabinet size remains unchanged from conventional models, the PAS Series incorporates a high-efficiency switching circuit and a power-factor correction circuit to meet the needs of today's users. Provided with Kikusui-developed digital communication functions (TP-BUS: Twisted Pair Bus) as standard equipment, this series can handle power supply systems ranging from small scale (two units) to large scale systems (up to 448 units when used in combination with GPIB) at low cost. The distance between the controller and power supplies can be extended up to 200 m for use in applications such as plant power supply control from the office PC.

Features

- Equipped with a power-factor correction circuit
- High power conversion efficiency of 75%
- Equipped with digital communication functions
- Four-digit indication display unit
- Multifunction dial
- Supporting universal AC input

Functions

■ Attractive new design

The dynamic new color scheme of the PAS Series features a gray-white base with a front louver in vibrant blue. Models in this series are controlled with a multifunction dial and feature a high-brightness four-digit indication display unit. Display digits provide readings down to 10mV/1 mA, and a output power (W) display function is also provided. The end result is improved operability and visibility.

■ Handling margin testing with capacity

The maximum rated output voltage of conventional products is typically a range consisting of 6 V, 10 V, 20 V, 35 V, and 60 V. The PAS Series offers a maximum rated output voltage of 10 V, 20 V, 40 V, 60 V, and 80 V, in response to changes in the voltage ranges required for margin testing due to the conversion of equipment such as DC-DC converters, batteries, automobile electrical components, and motor-operated tools to high voltage or large capacity formats. This allows the PAS Series to handle tests at 150% of 24 V (36 V) or at 150% of 48 V (72 V) with capacity to spare.

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Functions

External analog control functions

- Constant-voltage/constant-current output control function
 - Output control based on external voltage (0 to 10 V)
 - Output control based on external resistance (0 to 10 kΩ)
- Output ON/OFF control function
 - External contact-based output ON/OFF control
 - External voltage-based output ON/OFF control
- Power switch control function
 - External contact-based power switch OFF control
 - External voltage-based power switch OFF control

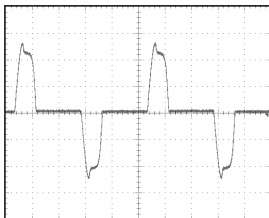
Analog read-back function

- Monitor output (voltage output)
 - Output voltage monitoring
 - Output current monitoring
- Status signal output (contact signal output)
 - CV mode signal, CC mode signal, Output ON signal, Alarm signal, POWER ON signal

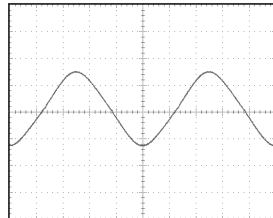
High efficiency and high power factor

The PAS Series employs a high-efficiency switching circuit that inherits its core circuit from the PAK-A Series, achieving a power conversion efficiency of 75% (70% or better for 10V models). Models in the series incorporate a power-factor correction circuit with a power factor of 0.98 that suppresses higher harmonic currents. The PAS Series reduces power consumption cost, as well as heat-dissipation design cost, when the system is configured.

AC input current waveform



PAK-A Series



PAS Series

High-resolution meter displays power (W)

Four digits are used to display output voltage/current at the same time. The configurable digits are more brightly lit than the others, to ensure easy and safe verification/operation. The output power is also displayed. You can set the output voltage/current while monitoring the output power [Voltmeter measurement accuracy: $\pm (0.2\% \text{ of rdg} + 5 \text{ digits})$ ammeter measurement accuracy: $\pm (0.5\% \text{ of rdg} + 5 \text{ digits})$].



* The maximum number of digits displayed on the ammeter (i.e. the location of the decimal point) varies according to the model.

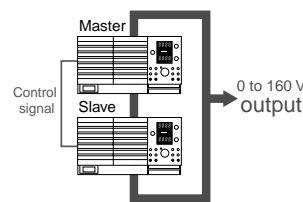
Maximum Output Current	Maximum Display
Model less than 10A	9.999
Model above 10A less than 100A	99.99
Model above 100A	999.9

Parallel and series operation

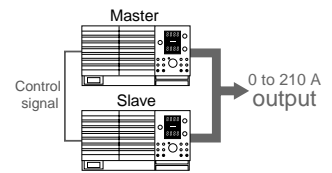
For master/slave use, the PAS Series handles parallel (current expansion) and series (voltage expansion) operations. The maximum number of units that can be connected in series is two, while the maximum number of units connectable for parallel applications is five for the 350W type, three for the 700W type, and two for the 1000W type.

* The same model types must be used for a given operation. The units cannot be connected in series and parallel simultaneously.

Connecting two PAS80-13.5 in series

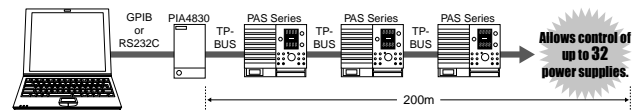


Connecting two PAS10-105 in parallel



Digital communication function

In addition to output control based on external voltage, external resistance, or contact signal (so-called external analog inputs), the PAS Series offers a digital remote control read-back function (TP-BUS: Twisted Pair Bus) as standard equipment. This TP-BUS enables a single power supply controller (PIA4830) to control up to 32 PAS Series units.



Universal mode available for AC input

For AC input, a universal mode (continuous between 100 V and 240 V) is used instead of a 100 V / 200 V switchover type. The AC power connector* (AC inlet) used ensures safe and easy connections.

* Only with 350 W types and 700 W types. For 1,000 W types, a terminal block is used.

Front-panel auxiliary output terminal

A front-panel auxiliary output terminal helps you to remove outputs with ease. Please note, however, that an accident may result in the event of inadvertent user contact. Moreover, this terminal can use only a limited current. Thus, when a large amount of power is used, the maximum load can not be realized. To meet your needs, Kikusui offers the extended ET11 terminal, available as a separate option.



The ET11 is a terminal block box that is mountable on the PAS Series, using a magnet.

Maximum rated output	30 A (600 V or less)
Dimensions	About 124 mm (W) X 34 mm (H) X 100 mm (D)
Weight	about 700 g
Cable length	About 60 cm
Accessory	Magnet, terminal protective cover

PAS series

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Panel Description

OUTPUT switch
Turns the output ON/OFF.

CONFIG switch
Used to make and check control settings for functions.

LOCK switch
Limits the operation of the front panel. Also used to disable switches other than the OUTPUT switch and to disable dial operation.

ADDRESS switch
Sets the GPIB address.

POWER switch

VOLTAGE switch
Selects the number of digits in voltage setting. Used together with the SHIFT switch, this toggles the display between voltage and output power.

CURRENT switch
Selects the number of digits in current setting. Used together with the SHIFT switch, this toggles the display between the current and the output power.

SET switch
Used to make and check output voltage/current value settings.

OVP/OCF switch
Used to make settings for the overvoltage/overcurrent protection functions.

Dial
Used to make voltage/current value settings and CONFIG settings. Also used to set the node address.

J1
The connector used to select functions such as analog remote control and serial/parallel operation.

TP-BUS
The connector used in remote control to connect the unit to the power supply controller (PIA4830) using a twisted-pair cable.

DC OUTPUT
The bus bar has 3-mm and 4-mm screw holes and M8 bolt holes. (Screws and M8 nuts and bolts are included with the product.)

Setting List
On top of the unit is a sticker with a list of control and CONFIG settings.

Sensing Terminal
The terminal used to connect a sensing cable.

AC INPUT
The AC power connector (350 W and 700 W types) or terminal block (1000 W type).

▲ Top front ▲ Top rear

Screw holes(3mm)
Screw holes(4mm)
Bolt holes(M8)

■ [Reference] Pin assignment list for J1 connector

Signal name	Description
1 A COM	Common *1
2 D COM	Common *1
3 OUT ON / OFF CONT	ON/OFF of outputs [OFF when L (or H) of the TTL level signal is input.*2]
4 EXT-V CV CONT	Output voltage control by an external voltage
5 EXT-V CC CONT	Output current control by an external voltage
6 EXT-R CV CONT	Output voltage control by external resistance
7 EXT-R CC CONT	Output current control by external resistance
8 VMON	Output voltage monitor
9 IMON	Output current monitor
10 SHUT DOWN	Shutdown (Outputs or the POWER switch are turned off when L of the TTL level signal is input.*2)
11 SER IN+	Positive input terminal used in master-slave series operation.
12 PRL IN+	Positive input terminal used in master-slave parallel operation.
13 SER IN-	Negative input terminal used in master-slave series operation.
14 PRL IN-	Negative input terminal used in master-slave parallel operation.
15 NEXT PRL OUT+	Positive output terminal used to output to the next unit in master-slave parallel operation.
16 NEXT PRL OUT-	Negative output terminal used to output to the next unit in master-slave parallel operation.

Signal name	Description
17 STATUS COM	Common for the status signal from Pin 18 through Pin 22
18 CV STATUS	ON during CV operation *3
19 CC STATUS	ON during CC operation *3
20 ALM STATUS	ON when the protective circuit is working or when the shutdown signal is input (Hold for about half of a second when the POWER switch is OFF). *3
21 OUTON STATUS	ON when the output is ON *3
22 PWR OFF STATUS	Turns on when the internal sub power supply is activated with the POWER switch off. (open collector output by a photocoupler, held for approx. 0.5 s) *3
23 SER OUT+	Positive output terminal used in master-slave serial operation.
24 PRL OUT+	Positive output terminal used in master-slave parallel operation.
25 SER OUT-	Negative output terminal used in master-slave serial operation.
26 PRL OUT-	Negative output terminal used in master-slave parallel operation.



Pin assignment of J1 connector

*1: Connected to the negative side of the sensing input (-S) when the remote sensing function is used, and to the negative (-) output when the function is not used.
*2: The internal circuit is pulled up to +5 V with 10 kΩ. *3: Open collector outputs from the photocoupler (maximum voltage of 30 V, maximum current of 2 mA). Insulated from the control circuit.

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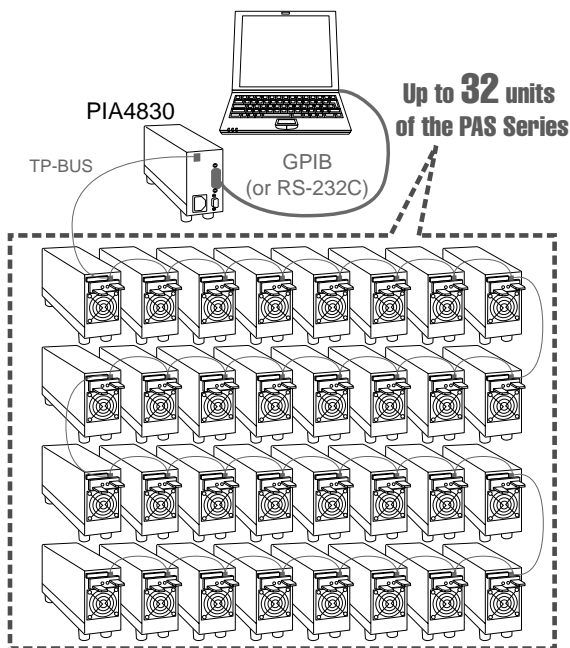
Application

■ Digital control

The PAS Series has an output control function that uses an external voltage, external resistance, and the contact signal (external analog inputs). It also offers, as a standard feature, a digital remote control read-back function (using the TP-BUS, or Twisted Pair-Bus). This TP-BUS permits a single power-supply controller (PIA4830) to control up to 32 units of the PAS Series, using a single GPIB address. The control signal cable can be extended up to a total length of 200 m, allowing easy wiring and efficient rack installation when building a large-scale power system.



● Example of TP-BUS connection



[Reference] Device message list

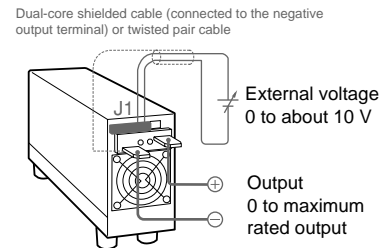
Message	Function
*IDN?	Checks the model name of the power supply controller.
IOUT?	Checks the output current value.
ISET	Sets the output current.
ISET?	Checks the preset current value.
LOCK	Enables or disables the operation of front-panel switches.
OCSET	Sets the OCP trip point.
OCSET?	Checks the OCP trip point.
OUT	Turns outputs ON/OFF.
OVSET	Sets the OVP trip point.
OVSET?	Checks the OVP trip point.
POW	Shuts down the POWER switch.
VOUT?	Checks the output voltage value.
VSET	Sets the output voltage.
VSET?	Checks the preset voltage value.

■ Output control by an external voltage

The output voltage and current can be controlled using an external voltage.

Object of control	Voltage*	Input impedance
Output voltage	0 to about 10 V	About 10 kΩ
Output current	0 to about 10 V	About 10 kΩ

* Float, do not ground, the external voltage.

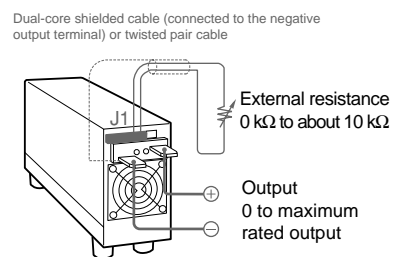


■ Output control by external resistance

The output voltage and current can be controlled using external resistance. For the control mode, you can select between the maximum rated mode at 10 kΩ and the FAILSAFE mode, which protects the load against an excess voltage (0 V or 0 A at 10 kΩ), even if resistance fails during operation.

Object of control	Control resistance
Output voltage	0 to about 10 kΩ
Output current	0 to about 10 kΩ

* For resistance control, use a 1/2 W (or greater) metal-film resistor or wire-wound resistor that has a small temperature coefficient and high temporal stability.

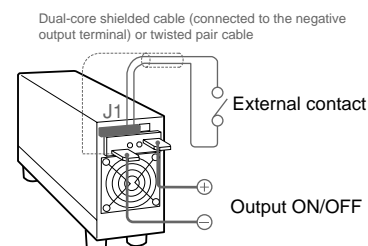


■ ON/OFF control of output

The output can be turned ON/OFF via the external contact signal.

Control mode	Details of control
LOW=ON	Turns the output ON when L of the TTL level signal is input.
LOW=OFF	Turns the output ON when H of the TTL level signal is input.

* Use an external contact of a rated value of at least DC 5 V and 10 mA.



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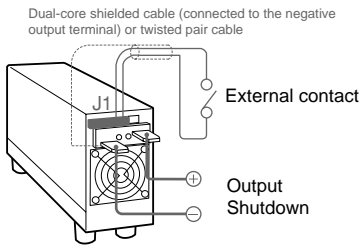
Application

■ Shutdown control of output

The external contact signal can be used to conduct shutdown control of the output.

Control mode *1	Details of control
Enable	Trips the POWER switch when L of the TTL level signal is input.
Disable	Turns the output OFF when L of the TTL level signal is input.*2

*1: POWER switch trip settings. *2: The POWER switch does not trip.



■ Remote monitoring

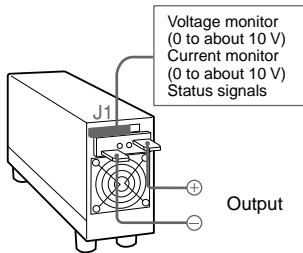
A signal is output to monitor the output voltage and current. Also, a status signal can be provided, to allow external monitoring of the status of operation.

Monitor output	
Output voltage monitor	0 to rated output voltage → 0 to about 10 V
Output current monitor	0 to rated output current → 0 to about 10 V

* Rated value for monitor output: output impedance of 1 kΩ or less, maximum current of about 10 mA.

Output of status signal	
CV mode signal	Low during constant-voltage operation.
CC mode signal	Low during constant-current operation.
Output ON signal	Low when the output is OFF.
Alarm signal	Low when the protective circuit is working.
POWER ON signal	Low when the POWER switch is OFF.

* Each output is an open collector output on the photocoupler.
* Rated value for each signal terminal: maximum applied voltage of 30 V, maximum current of 2 mA.



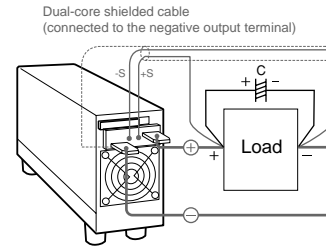
■ Remote sensing

The remote sensing function is used to compensate a voltage drop caused in the cable between the power and the load or by contact resistance of the cable. A voltage drop poses a more serious problem as the current increases. A voltage drop of up to about 0.6 V can be prevented on one side when you turn on the sensing switch and shift the voltage-sensing point to the load.

* When remote sensing is conducted near the maximum output voltage, the output of this product is limited to 105% of the maximum output voltage. The 20 V models are set to a maximum output voltage of 21 V. Because of this, the rated voltage will be unavailable if you

attempt to compensate the maximum compensation voltage of 1.2 V (0.6 V one-way, x 2). To avoid this problem, use wire with a large enough cross-sectional area to reduce a voltage drop, so that a one-way voltage drop is limited to 0.5 V or less.

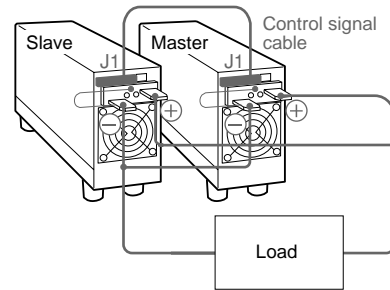
* When necessary, connect an electrolytic capacitor with at least 0.1 μF to a few hundreds of μF to the load at the shortest distance.



■ Master-slave parallel operation

Connecting multiple units of the same model in parallel can expand the current capacity. A single master is necessary to control outputs.

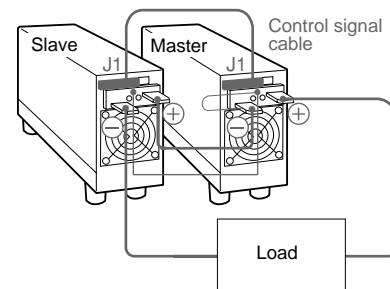
* Remote sensing or analog remote control, when necessary, must be conducted on the master.
* Up to five units can be connected in parallel with the 350 W type (a master and four slaves), three units may be connected with the 700 W type (a master and two slaves) and two units may be connected with the 1,000 W type (a master and a slave).



■ Master-slave series operation

Connecting multiple units of the same model in series can expand the output voltage. In this control, the upper (plus side) unit is used as the master. You have only to control the master to regulate slave outputs.

* Remote sensing or analog remote control, when necessary, must be conducted on the master.
* Up to two units (a master and a slave) may be connected in series.



VARIABLE-SWITCHING REGULATED DC POWER SUPPLIES (CV-CC)

Specifications

Model	Output		Constant Voltage				Constant Current			Other			Weight kg (approx.)
	CV	CC	Ripple	Source effect	Load effect	Transient response	Ripple	Source effect	Load effect	Input current	Inrush current	External dimensions	
	V	A	mV rms	mV or less	mV or less	ms (typical value)	mV rms	mV or less	mV or less	AC(100V/200V)A	A 0 to peak (Max)	TYPE	
PAS10-35	0 to 10	0 to 35	7	8	10	1	77	13.5	13.5	5.0 / 2.5	35	I	3
PAS10-70	0 to 10	0 to 70	11	8	10	1	185	17	17	10.0 / 5.0	70	II	5
PAS10-105	0 to 10	0 to 105	14	8	10	1	277	25.5	25.5	15.0 / 7.5	105	III	7
PAS20-18	0 to 20	0 to 18	7	13	15	1	40	11.8	11.8	5.0 / 2.5	35	I	3
PAS20-36	0 to 20	0 to 36	11	13	15	1	95	13.6	13.6	10.0 / 5.0	70	II	5
PAS20-54	0 to 20	0 to 54	14	13	15	1	143	20.4	20.4	15.0 / 7.5	105	III	7
PAS40-9	0 to 40	0 to 9	7	23	25	1	20	10.9	10.9	5.0 / 2.5	35	I	3
PAS40-18	0 to 40	0 to 18	11	23	25	1	48	11.8	11.8	10.0 / 5.0	70	II	5
PAS40-27	0 to 40	0 to 27	14	23	25	1	71	17.7	17.7	15.0 / 7.5	105	III	7
PAS60-6	0 to 60	0 to 6	7	33	35	1	13	10.6	10.6	5.0 / 2.5	35	I	3
PAS60-12	0 to 60	0 to 12	11	33	35	1	32	11.2	11.2	10.0 / 5.0	70	II	5
PAS60-18	0 to 60	0 to 18	14	33	35	1	48	16.8	16.8	15.0 / 7.5	105	III	7
PAS80-4.5	0 to 80	0 to 4.5	7	43	45	1	10	10.45	10.45	5.0 / 2.5	35	I	3
PAS80-9	0 to 80	0 to 9	11	43	45	1	24	10.9	10.9	10.0 / 5.0	70	II	5
PAS80-13.5	0 to 80	0 to 13.5	14	43	45	1	36	16.35	16.35	15.0 / 7.5	105	III	7

Common specifications

■ Input voltage	100 to 240 V AC (85 to 250 V AC), single phase, 47 to 63 Hz								
■ Power factor	0.98 typical value								
■ Efficiency	75% or better (70% or better for 10V models)								
■ Temperature coefficient	Constant-voltage output: 100 ppm/°C Constant-current output: 200 ppm/°C								
■ Indication meters									
Voltmeter (23±5°C)	Maximum display: 99.99, Four-digit green LED display Measurement accuracy: ± (0.2% of rdg* + 5digits) Setting resolution: Same as the display unit Setting accuracy: ± (0.1% of rtg** + 10 mV)								
Ammeter (23±5°C)	Maximum display: Four-digit green LED display <table border="1"> <tr> <th>Maximum Output Current</th> <th>Maximum Display</th> </tr> <tr> <td>Model less than 10A</td> <td>9.999</td> </tr> <tr> <td>Model above 10A less than 100A</td> <td>99.99</td> </tr> <tr> <td>Model above 100A</td> <td>999.9</td> </tr> </table> Measurement accuracy: ± (0.5% of rdg* + 5digits) Setting resolution: Same as the display unit Setting accuracy: ± (0.5% of rtg** + 20 mA) *:rdg = reading **: rtg = rating	Maximum Output Current	Maximum Display	Model less than 10A	9.999	Model above 10A less than 100A	99.99	Model above 100A	999.9
Maximum Output Current	Maximum Display								
Model less than 10A	9.999								
Model above 10A less than 100A	99.99								
Model above 100A	999.9								

■ Protective circuits	
Overvoltage protection	Voltage setting range: 10% to 110% of rated output voltage
Overcurrent protection	Current setting range: 10% to 110% of rated output current
Overheat protection	Activated by elevated internal temperatures
■ Environmental conditions	
Ambient temperature range for operation	0 to 50°C
Ambient humidity range for operation	20 to 85% RH
Storage temperature range	-25 to 70°C
Storage humidity range	90% RH or less
■ Cooling system	Fan-based forced-air cooling, front air-intake
■ Voltage to ground	±500 V
■ External dimensions	Type I: 71W×124(150)H×350(420)Dmm Type II: 142.5W×124(160)H×350(420)Dmm Type III: 214W×124(160)H×350(420)Dmm
■ Accessories	Operating Manual, power cord (approx. 3 m long, without power plug) Rear output terminal protection cover, TP-BUS connector

Option

Product	Model	Remarks
Extended Terminal	ET11	The terminal block box can be installed on the unit with a magnet. Maximum rated output of 30 A (600 V or less).
Power supply controller	PIA4830	Only for digital control.
Rack mount adapter (JIS)	KRA150	
Rack mount adapter (EIA)	KRA3	
Blank panel (1/6 width)	KBP3-6	
Blank panel (1/3 width)	KBP3-3	
Blank panel (1/2 width)	KBP3-2	