

**P A X / P B X S E R I E S**



**HIGH-SPEED DC POWER SUPPLY**

**High-speed programmable power source**

**PAX Series**

**High-speed bipolar power source**

**PBX Series**

Rise/fall time variable function (maximum 50  $\mu$ s)

Programmable sequence function with single step of 100  $\mu$ s

Power booster function (PBX series)

Compatible with GPIB/RS-232C (option)



**Suitable for simulation of DC power source transient phenomenon or instantaneous blackout!**

# High-speed programmable power source PAX SERIES

## Voltage variation test for automotive electric components

Test for ISO7637-2, pulse 2b (Engine stop simulation) and pulse 4 (Engine start simulation) can be performed.

## Operation test on on-board unit

It can be used as the drive power source for measurement of the solenoid valve open/close current in the fuel direct injection system or as the trigger unit for igniting the air bag.

## Input variation/instantaneous blackout test on DD converter

For a simulation test of current interruption with a DC/DC converter

## For operation test on semi-conductors

For the test source for electric devices, such as voltage source of FET bias characteristic measurement, forward drop voltage measurement ( $V_f$ ) of large current diode, etc.

**PAX35-10(0 to 35V/0 to 10A)**

**PAX35-20(0 to 35V/0 to 20A)**

**PAX35-30(0 to 35V/0 to 30A)**

High-speed operation at  $50 \mu\text{s}$  (CV, CC) <sup>\*1</sup>

Low noise  $0.2\text{mVrms}/3\text{mVp-p}$  <sup>\*2</sup>

Programmable sequence function with single step of  $100 \mu\text{s}$

Compatible with GPIB/RS-232C (option)

\*1 : In fast mode \*2 : PAX35-10/normal mode

High-speed operation at 50  $\mu$ s (CV), 100  $\mu$ s (CC) \*1  
For power booster of generator (DC to 30 kHz) \*2

Since the operation covers 4 quadrants, the power sink is available.

Programmable sequence function with a single step of 100  $\mu$ s

Function that displays measurements such as peak value, RMS value, maximum/minimum values, etc.

Compatible with GPIB/RS-232C (option)

\*1 : In fast mode \*2 : CV fast mode/through setting

**PBX20-5( $\pm$ 20V/ $\pm$ 5A)**

**PBX40-2.5( $\pm$ 40V/ $\pm$ 2.5A)**

**PBX20-10( $\pm$ 20V/ $\pm$ 10A)**

**PBX40-5( $\pm$ 40V/ $\pm$ 5A)**

**PBX20-20( $\pm$ 20V/ $\pm$ 20A)**

**PBX40-10( $\pm$ 40V/ $\pm$ 10A)**

**For a constant current source of high-speed pulse plating and driver of DC servo motor!**

# High-speed bipolar power source PBX SERIES

## Constant current source of high-speed pulse plating

It can be used as a constant current source of high-speed pulse plating for surface treatment of the hard disk drive head or copper plating of the semi-conductor pattern.

## Evaluation test of DC servo motor

As the driver of the DC servo motor, control signals can be amplified and test patterns can be generated.

## Pulse charging/discharging of battery

It can be used as a testing unit for pulse charging/discharging of the lithium secondary battery.

## Drive/control of solenoid coil

It can be used as a constant current source for exciting an electromagnet.



# Suitable for simulation of DC power source transient phenomenon or instantaneous blackout!

## High-speed programmable power source

# PAX SERIES

### General

The PAX series has the design concept of automation and labor saving. It is a programmable DC regulated power source that is designed based on high reliability and safety. Since the power amplifier method is used, low ripple noise and highly stable operation are achieved. High-speed operation is also available. Multi-functions with CPU control are available. In particular, the output sequence can be controlled. The desired "voltage/current waveform" can be generated. Various interfaces are provided. It is compatible with various systems through GPIB, RS-232C or our unique MCB (multi-channel bus).

### Two operation modes

● **FAST mode** : The output voltage or output current can be changed at a very high-speed. It is the mode that is suitable for constant current power source or for high-speed sequence operation. In this mode, the rise/fall time of the output voltage or output current can be selected from 50  $\mu$ s, 500  $\mu$ s and 5 ms.

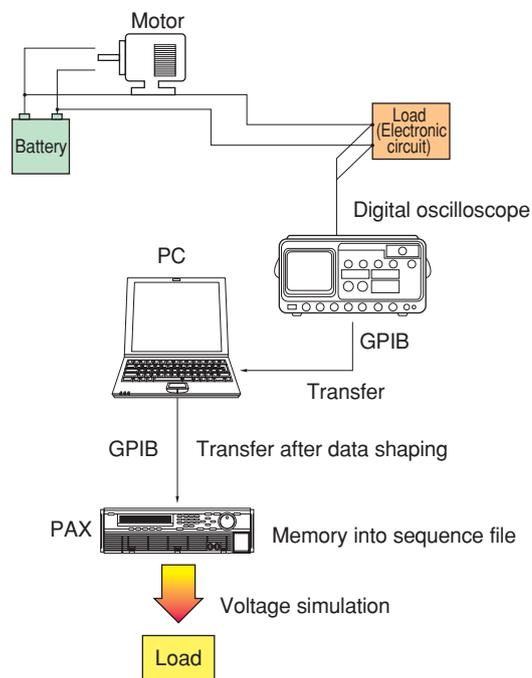
● **NORMAL mode** : The capacitor is connected to the output. It is the mode that can obtain very stable operation with low ripple noise that features the series regulator at 50 ms voltage/current rise and fall characteristics equivalent to the conventional power source. In this mode, low ripple noise of 0.2 mVrms/3 mVp-p (PAX35-10/NORMAL mode) is obtained.

### Current sink function

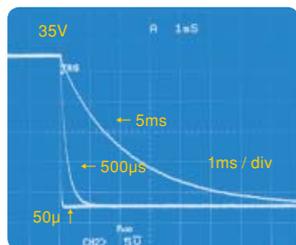
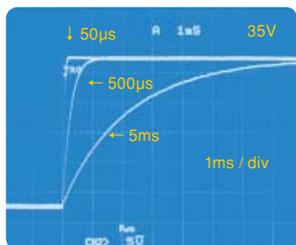
If the load output voltage is lower than the rated output voltage of the PAX series, about 20% of the rated output current can be absorbed with the current sink function. The output can be operated at a high-speed.

### Power source simulation at the engine start for electronic equipment mounted on a vehicle (example)

First, capture the terminal voltage waveform that is generated in electronic equipment at the start of the engine with a digital oscilloscope, and then save the waveform data in the PAX memory through the GPIB interface. The data saved in the memory can be operated even if it is separated from the GPIB. Therefore, in a test line, an actual load simulation can be done without a complicated system.

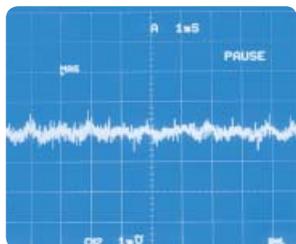


Output voltage rise characteristics in FAST mode    Output voltage fall characteristics in FAST mode



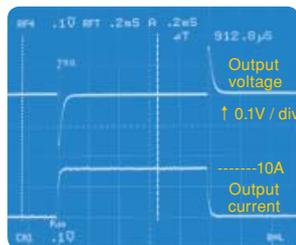
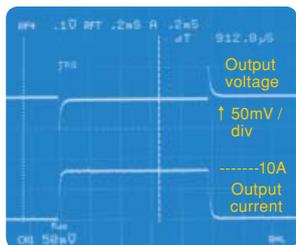
Ripple noise in NORMAL mode (PAX35-10, 35V/10A output)

Ripple noise in FAST mode (PAX35-10, 35V/10A output)



Transient response in NORMAL mode (PAX35-10, 35V/10A output)

Transient response in FAST mode (PAX35-10, 35V/10A output)

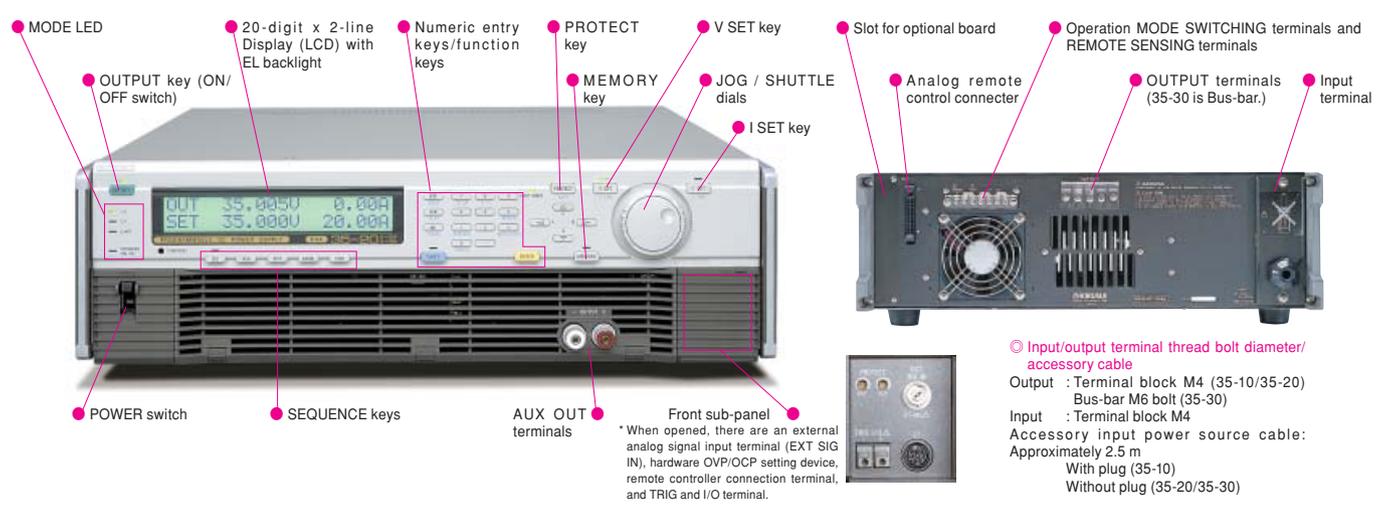


Example of normal sequence mode

Example of high-speed sequence mode



## Appearance and specifications



Model	PAX35-10	PAX35-20	PAX35-30
Input voltage	AC100V±10%, 50/60Hz, single phase (110, 120, 200, 220 and 240V are factory options)		
Input current (at full load)	8.5A	17.5A	25A
Rush current	13A (input voltage at AC110V)		
Output voltage	0 to 35.00V		
Resolution	1mV		
Temperature coefficient	100 ppm/°C (35 ppm/°C Typical value)		
Output current	0 to 10.00A	0 to 20.00A	0 to 30.00A
Resolution	1mA		
Temperature coefficient	150ppm/°C(50ppm/°C Typical value)		
CV (NORMAL mode)			
Ripple (rms/p-p *)	0.2mV/3mV	0.4mV/3mV	0.4mV/3mV
Load regulation	1mV	2mV	2mV
Line regulation	1mV		
Tr/Tf time (*)	50ms/50ms		
CV (FAST mode)			
Ripple (rms/p-p *)	2mV/10mV	2mV/10mV	3mV/10mV
Load regulation	1mV	2mV	2mV
Line regulation	1mV		
Tr/Tf time (*)	50µs, 500µs, 5ms/50µs, 500µs, 5ms		
CC (NORMAL mode)			
Ripple (rms)	2mA	2mA	3mA
Load regulation	7mA		
Line regulation	1mA	2mA	3mA
Tr/Tf time (*)	50ms/50ms		
CC (FAST mode)			
Ripple (rms)	3mA	6mA	10mA
Load regulation	10mA		
Line regulation	1mA	2mA	3mA
Tr/Tf time (*)	50µs, 500µs, 5ms/50µs, 500µs, 5ms		
Protection function	Soft OVP, soft OCP, soft OCP delay, hard OVP, hard OCP, OHP		
Operation temperature and humidity range	0 to +40°C/30 to 80%rh		
Storage temperature and humidity range	-20 to +70°C/20 to 80%rh		
Outline (type)	I	II	II
Dimensions ( ) indicate the largest parts	430(450)W×132(147)H×450(510)Dmm		
Weight (approx.)	26kg	33kg	40kg

\* mark refers to the standard value (typical value) and does not assure the performance. Use it as a guideline during operation.

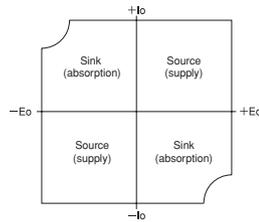
# For a constant current source of high-speed pulse plating and driver of DC servo motor!

## High-speed bipolar power source

# PBX SERIES

### General

The PBX series is the bipolar type DC regulated power source that can continuously change both + and - polarities passing through 0 without changing the output terminal. With the power amplifier method, low ripple noise and highly stable operation are achieved. High-speed operation is also available. Since the operation covers 4 quadrants, inductive load or capacitive load can be driven. The power can be supplied (source) and absorbed (sink). Since the constant voltage mode (CV) and constant current mode (CC) can be set individually, it can be used for the constant current power source and the voltage control current source as well as the constant voltage power source. The sequence function allows for the arbitrary voltage or current waveform output, and it is compatible with various systems through various interfaces.



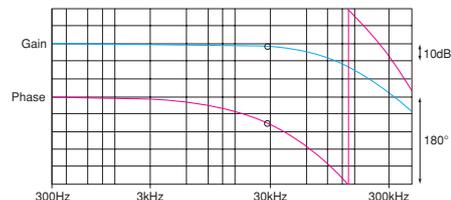
### Four operation modes

- **CV FAST mode** : The output voltage can be changed at a very high-speed. It is the mode that is suitable for high-speed sequence operation. In this mode, the rise/fall time of the output voltage can be selected from 50 μs, 500μs and 5 ms. At "through setting", the frequency characteristic is 30 kHz (rise/fall time conversion value: around 15μs).
- **CV NORMAL mode** : Using the power amplifier, highly stable operation with low ripple noise is available. The rise/fall time in this case is about 30 ms.
- **CC dynamic mode** : High-speed follow-up for dynamic load variation is available. In this mode, the rise/fall time of output current can be selected from 100 μs, 500 μs and 5 ms. At "through setting", the frequency characteristic is 10 kHz\* (rise/fall time conversion value: around 40μs).
- **CC static mode** : Stable operation can be achieved even for a large variation of the load. The rise/fall time in this case is about 50 ms.

### Power booster function

For the input from the EXT SIG IN terminal of the front sub-panel, the amplification factor (AMPL: amplitude) can be determined. Using this, the fixed level generator without the DC offset can be changed to a high power unit with variable offset and variable level. The frequency characteristic is approximately 30 kHz in CV FAST mode and approximately 10 kHz\* in CC dynamic mode.

- Frequency characteristic from PBX40-10 EXT SIG IN terminal to output terminal

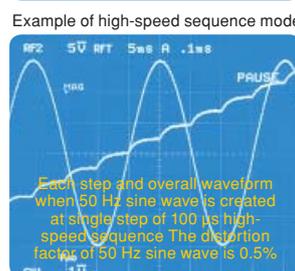
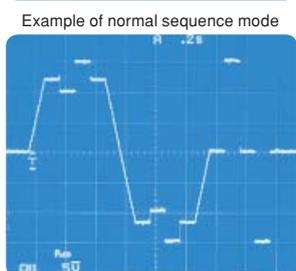
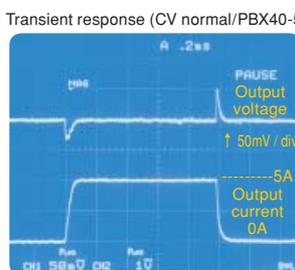
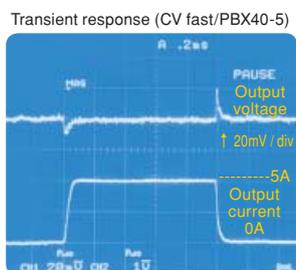
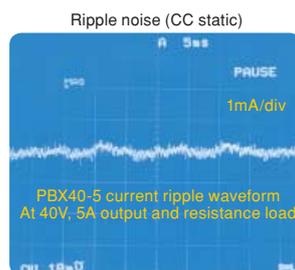
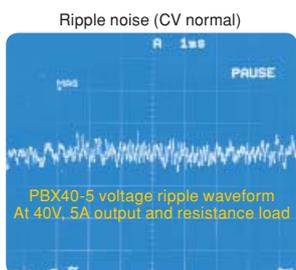
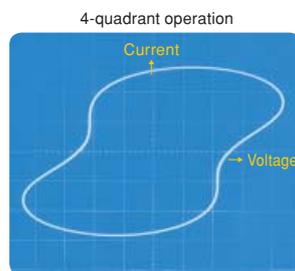
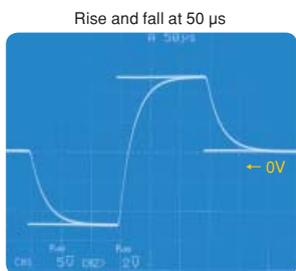


### Measurement display function

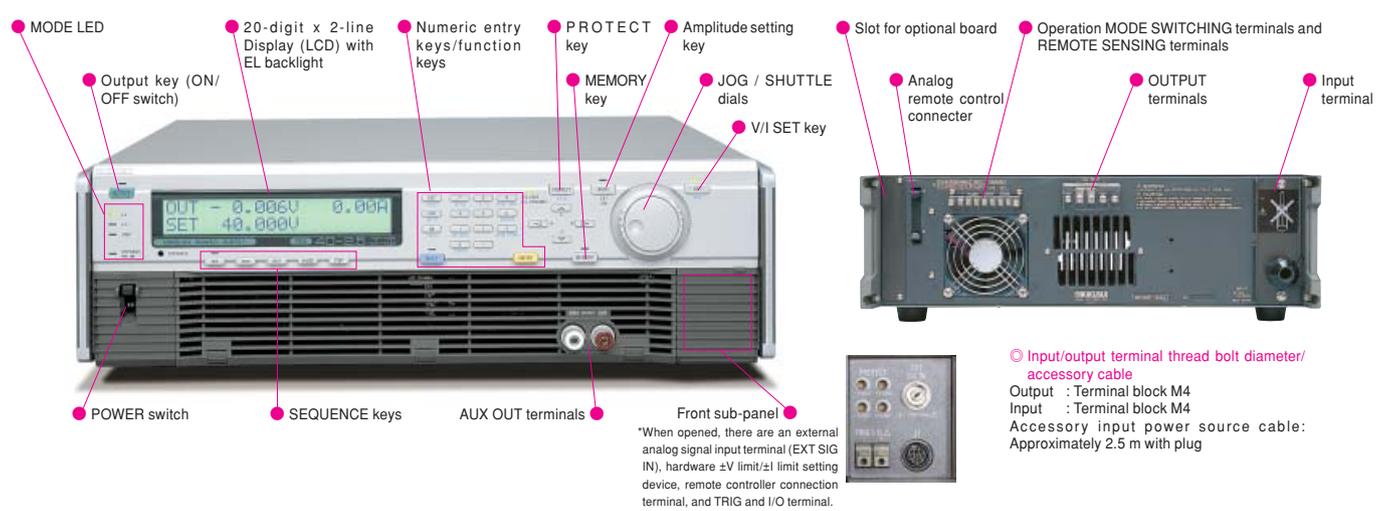
The PBX series panel display has the function to display the peak value, RMS value, and maximum/minimum value in addition to the DC output value.

- DC ..... Display of DC output value
- RMS ..... Display of RMS output value
- ±Peak Vout ..... Display of + or - peak output voltage
- ±Peak Iout ..... Display of + or - peak output current
- Display Time ..... Display of time setting of peak value (1 second to 30 seconds)
- Min Max Record .... Record display of maximum/minimum values

\*Note: Frequency characteristic in the 20V model. It is 5 kHz (rise/fall time conversion value: around 80μs) in the 40V model.



## Appearance and specification



Model	PBX20-5	PBX20-10	PBX20-20	PBX40-2.5	PBX40-5	PBX40-10
Input voltage	AC100V $\pm$ 10%, single phase 50/60Hz (110, 120, 200, 220 and 240V are factory options.)					
Input current (at full load)	3A	6A	10A	3A	5A	9A
Rush current	13A (input voltage at AC110V)					
Constant voltage (CV)						
Output voltage	$\pm$ 20.00V			$\pm$ 40.00V		
Resolution	1mV					
Temperature coefficient	100ppm/ $^{\circ}$ C					
Ripple noise (rms/p-p *)	FAST: 2 mV/10 mV, NORMAL: 1 mV/10 mV					
Load regulation	Both fast and normal are 0.005%+1 mV					
Line regulation	Both fast and normal are 0.005%+1 mV					
Rise time (*)	FAST mode: 50 $\mu$ s, 500 $\mu$ s, 5 ms NORMAL mode: 30 ms					
Fall time (*)	FAST mode: 50 $\mu$ s, 500 $\mu$ s, 5 ms NORMAL mode: 30 ms					
Frequency characteristic -3 dB point (*)	30kHz					
Constant current (CC)						
Output current	$\pm$ 5.00A	$\pm$ 10.00A	$\pm$ 20.00A	$\pm$ 2.50A	$\pm$ 5.00A	$\pm$ 10.00A
Resolution	1mA					
Temperature coefficient	100ppm/ $^{\circ}$ C					
Ripple noise (dynamic) rms	2mA	3mA	1mA	2mA	2mA	2mA
Ripple noise (static) rms	2mA	4mA	1mA	2mA	2mA	3mA
Load regulation	0.01%+1mA	0.01%+2mA	0.01%+1mA			
Line regulation	0.01%+1mA	0.01%+2mA	0.01%+1mA			
Rise time (*)	Dynamic: 100 $\mu$ s, 500 $\mu$ s, 5 ms Static: 50 ms					
Fall time (*)	Dynamic: 100 $\mu$ s, 500 $\mu$ s, 5 ms Static: 50 ms					
Frequency characteristic -3 dB point (*)	10kHz			5kHz		
Protection function	$\pm V$ limiter (soft, hard), $\pm I$ limiter (soft, hard), OVP (+, -), limit delay, OHP					
Operation temperature and humidity range	0 to +40 $^{\circ}$ C/30 to 80%rh					
Storage temperature and humidity range	-20 to +70 $^{\circ}$ C/20 to 80%rh					
Outline (type)**	I	II	II	I	II	II
Weight (approx.)	22kg	30kg	37kg	22kg	30kg	37kg

\*\* External dimensions I: 430 (450) W $\times$ 132 (147) H $\times$ 450 (510) Dmm II: 430 (450) W $\times$ 132 (147) H $\times$ 550 (610) Dmm ( ) indicate the largest parts.  
 \* mark refers to the standard value (typical value) and does not assure the performance. Use it as a guideline during operation.

# Various functions (common for all series) that can be used in numerous operations...

## Large LCD and JOG / SHUTTLE dials

Since the display uses a large LCD with EL backlight, setting items such as the output voltage or output current can be easily viewed in symbol characters. Value input or menu selection on the main unit panel can be made using the JOG / SHUTTLE dials, which gives emphasis to analog operation, in addition to input with the numeric keypad or arrow keys.

▼Liquid crystal display with backlight (PAX)



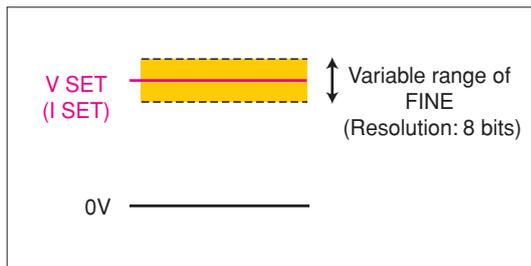
▼Jog, shuttle dial (PAX)



## High resolution setting with the FINE function

Usually, the set resolution of the output voltage and output current is 10 mV and 10 mA. With the FINE function, finer output can be set. Settings can be changed in steps of approximately 500  $\mu$ V (\* Approximately 250  $\mu$ V for the 20V model of the PBX series).

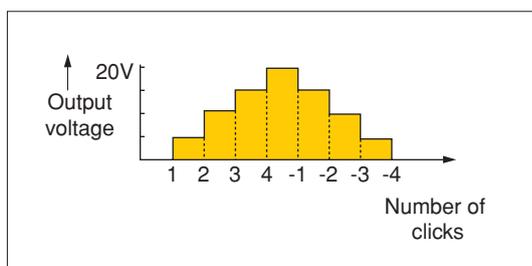
The FINE setting is added to the V set (I set) value as an offset.



## RESOLN (resolution) function

The click resolution of the voltage or current value can be set with a jog or up/down key. With the up/down key, the resolution for one click can be set to approximately 40% (\* about 50% for PBX) of 10 mV and 10 mA to the rated output.

For example, if the click resolution is set to 5V, an increase or decrease can be made in steps of 5V for each click.



## Setup function

Many set values of action such as voltage/current set values, OVP (over-voltage protection), OCP (over-current protection), TrTf (rise/fall time of output), etc. can be stored in 10 setup memories in the unit. The specified setup memory can be retrieved at the same time.

●Setup items

PAX series	PBX series
V SET (I SET)	
V FINE (I FINE)	
V RESOLN (I RESOLN)	
Software protection level	
OVP protection action	
OCP delay value	VLimit/OVP Limit time delay
MCB action	
Setting of rise/fall time (Tr Tf)	
-	Measurement display mode
-	Display time
-	Amplitude of power booster
Details of memories A, B, C, and D	

## Remote controller

With the special full remote controller (option), the same operations that can be performed on the unit panel can be performed on the handset. The same description as that on the unit panel is shown on the LCD of 20 digits x2 lines.



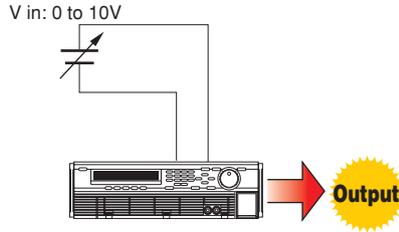
\* The cable can be attached to upper or lower part of the remote controller.

### Analog remote control function

From the remote control terminal at the rear panel, the output voltage and output current can be controlled with the analog signal of the external voltage or external resistance.

#### Control of output voltage and output current with external voltage

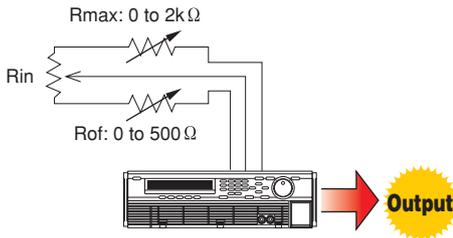
With an input of 0 to 10V ( $\pm 10V$  for PBX), variation from about 0V to the rated voltage or rated current can be made.



#### Control of output voltage and output current with external resistance

With an input of 0 to 10 k $\Omega$ , variation from about 0 to the rated voltage or rated current (from - rated voltage/current to + rated voltage/current for PBX) can be made. In control with external resistance, the offset and the maximum values are adjusted and finer settings are also available.

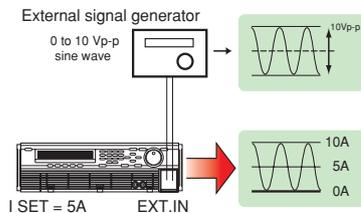
● With Rin 0 to 10 k $\Omega$ , variation from 0 to the rated value can be made. (Offset and maximum values can be adjusted with Rof and Rmax)



For the control set value with an analog signal and the set value with key input on the panel or the set value from the interface including GPIB, added values are output.

#### (Example of PAX)

When inputting setting of 5A from the PAX35-10 panel and a 10 Vp-p sine wave is input from the front sub-panel EXT.IN, the output waveform is as shown below. (\*The frequency characteristics depend on Tr/Tf settings.)



#### (Example of PBX)

When inputting setting of +20V from the PBX40-5 panel and -1V is input to the rear remote control terminal, the output is +16V.  
[+(20V)+(-4)=+16V]

#### Control with external contact

When the external contact is turned ON, the output can be OFF or the POWER switch can be blocked.

### Analog monitoring function

#### Voltage monitor

For output voltage from 0V to the rated value, the monitor voltage from approximately 0V to approximately 2V ( $\pm$  approx 2V for PBX) is output.

#### Current monitor

For output current from 0A to the rated value, the monitor voltage from approximately 0V to approximately 2V ( $\pm$  approx 2V for PBX) is output.

#### Various signal outputs

Various signals indicating the operation status of the unit are output. Since the output is from the photo coupler, various signals isolated from the unit are output.

**CC mode signal** ..... Photo coupler is ON during C.C operation.

**CV mode signal** ..... Photo coupler is ON during C.V operation.

**Output ON signal** ..... Photo coupler is ON during output ON.

**Alarm signal** ..... Photo coupler is ON during OVP or OHP operation.

**Common (floating)**.... Example: External LEDs are turned ON with various signals.

### Memory function

In 4 memories of A to D, each of the set values and FINE values of the output voltage and output current can be stored. They can be freely recalled with the MEMORY key or jog operation.

### Key lock function

The JOG / SHUTTLE dials and key input on the front panel are disabled, and thus the settings cannot be changed with an inadvertent action.

### Easy calibration

Calibration can be easily performed on the panel, using a voltmeter and shunt resistor.

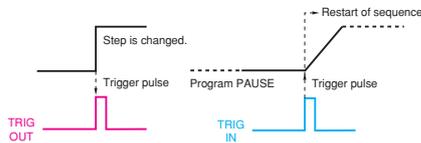
### Configuration

The operation status at the time of turning power on or the system configuration can be set. The set details are stored in the memory of the unit, and they can be recalled when turning power on. The configuration menu has output ON/OFF status selection when power on, remote control with analog signal, or interface control settings with GPIB or RS-232C.

## Sequence function

The PAX and PBX series have the sequence function. The sequence function automatically performs the change pattern (sequence pattern) of predetermined output voltage and output current. Set values and execution time of the output voltage and output current are input from the unit panel or optional GPIB or RS-232C interface to create and execute the pattern.

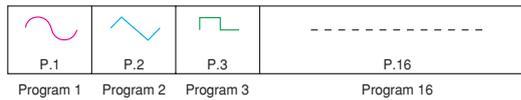
When the trigger output is set, the sequence can be started (the PAUSE status is cancelled) for trigger pulse output from the TRIG I/O terminal or for trigger input from the TRIG I/O terminal of the front sub-panel along with a step change in the program.



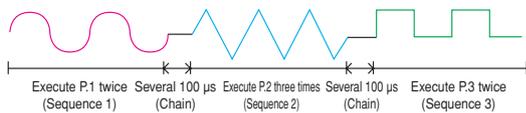
### General description of sequence creation

As shown below, set the basic program patterns of P1, P2... Programs can be set up to P.16. Then, specify the program number for execution or the chain location at the end of repetition. Create and execute the sequence pattern.

#### Example of program pattern



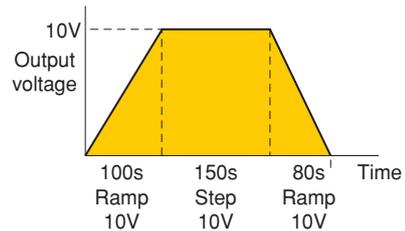
#### Sequence pattern [Example]



The sequence can be selected from two operation modes by execution speed and output settings of voltage and current.

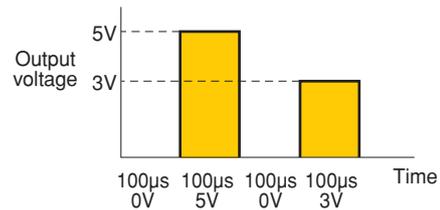
### Normal sequence mode

Ramp waveform (slope-shaped change) can be set in one step. It is best suited to create the sequence pattern.



### High-speed sequence mode

Each step is controlled at a high-speed of 100 μs maximum. This mode is suitable for the simulation of complicated waveforms such as instantaneous blackout or transient phenomenon. In the high-speed sequence, output settings for each step are determined to voltage mode and current model only. Each step is executed at a high-speed. (Max. 100 μs. Each step is executed at the same time.)

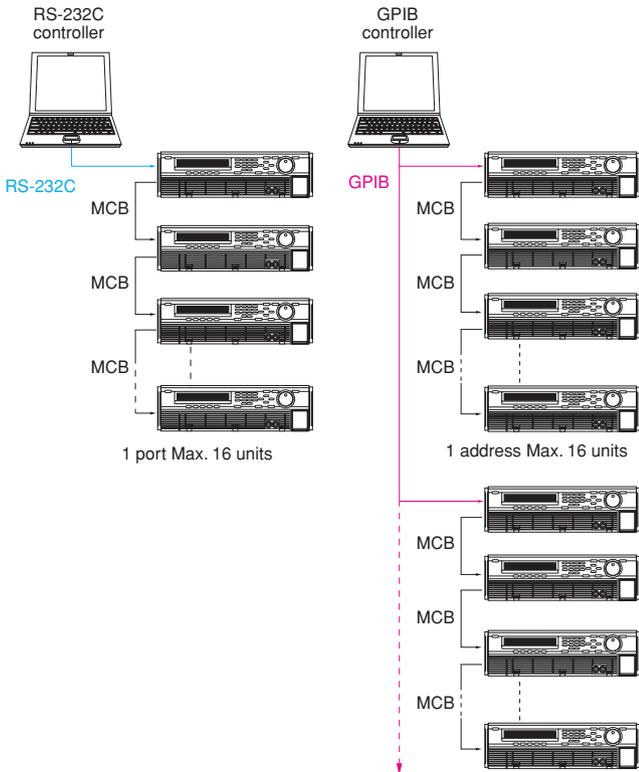


	Normal sequence operation (NORMAL speed mode)	High-speed sequence operation (FAST speed mode)
Operational output (Mode)	Voltage (NV mode), current (NI mode) Voltage/current (NVI mode) * NVI is for PAX only.	Voltage (FV mode), current (FI mode)
Step execution time (Time Unit)	1. Millisecond range (to 9999ms) 2. Second range (to 999.9s) 3. Minute range (to 999m59s) 4. Hour range (to 999h59m) (The desired values are able to be set in the same range for each step.)	0.1 ms to 100.0 ms (each step, fixed time)
Transient type of output	Step transition or ramp transition	Step transition
Trigger input/output function (TRIG I/O terminal)	Yes (Select either trigger input or trigger output)	Yes (Trigger output only)
Output ON/OFF function	Yes	No (Execute with "ON" status)
Pause function	Yes	No
Maximum number of steps	256	1024
Number of loops	1 to 9998, infinite times (Set 9999)	1 to 9998, infinite times (Set 9999)
Number of sequences	8	8
Number of programs	16	16

**Interface**

With an optional GPIB or RS-232C interface, remote control from a PC is available. In addition to the GPIB or RS-232C interface, use of our unique MCB (Multi-channel bus) interface (MC11S) can control a maximum of 16 units on-line from one address of the universal interface.

- IB11** (GPIB)
- RS11** (RS-232C)
- MC11S** (Multi-channel bus)



**Reliability**

■ **Simple internal structure**

The internal structure is designed to minimize wiring that may have an adverse effect on characteristics and to obtain stable characteristics for a long time. Therefore, characteristic variation at shipment is low.

■ **Use of durable parts**

The parts used inside are chosen based on reliability and safety. Since they are used with sufficient derating, the system can be used for a long time. In particular, all electrolytic capacitors, which are considered to be long-life parts, are compatible with 105°C.

■ **Use of temperature sensitive fan motor**

The fan motor detects the temperature of the internal heat sink and increases or decreases the fan revolution. Therefore, noise is very low at low load, as if there were no fan. As contamination of the filter, which is often observed in forced cooling, is limited, reliability is improved. Another advantage is that the temperature stress of the power device is reduced because the fan speed is controlled so that temperature variation of the internal heat sink may be minimized.

■ **Environmental characteristics**

- Static electricity test** ..... ESD simulator 15 kV
- Noise test** ..... 1.5 kV at pulse width of 50 ns to 1 μs
- Vibration test** ..... EIAJ MEA-25, JIS C0991
- Drop test** ..... Dropping height of 30 cm under packaged condition

**Safety**

■ **Protective function**

With two types of protective functions, software protection and hardware protection, a load is protected from incorrect operation or malfunction.

Software protection is set by key input on the panel or through the GPIB interface. Hardware protection is set with the semi-fixed resistor in the front sub-panel of the unit.

For soft OCP operation of PAX and output voltage limit operation of PBX, the time until action for error can be changed in the range from 0.05 to 9.99 sec. The auto protective function that automatically determines an increase ratio of 110%, 120% or 130% as the software protection set value for the voltage/current set values is also available.

■ **Measures for non-burning**

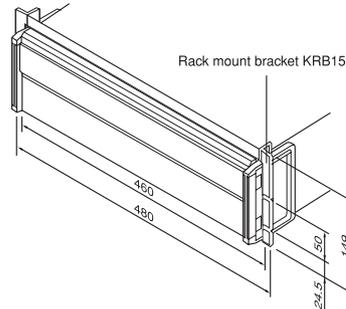
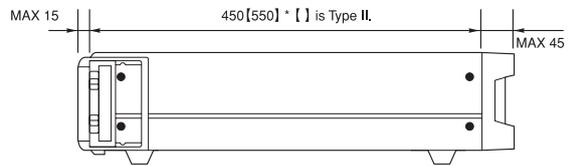
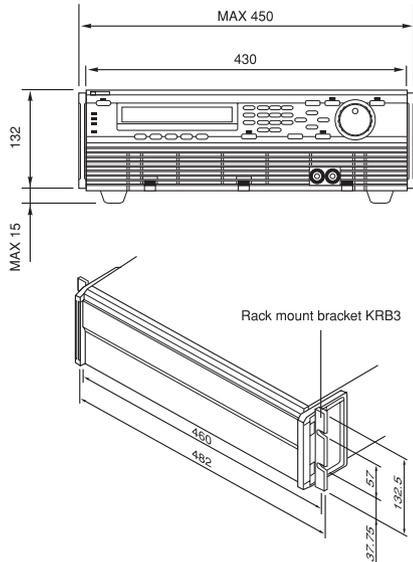
The board uses a glass epoxy (FR-4, CEM-3). Wiring materials are self-extinguishing heat-resistant wires. A flame retardant resin of 94V0 or equivalent is selected for the panel and the louver.

■ **Prevention of rush current**

If the power switch ON/OFF is repeated, the rush current prevention circuit is always active for ON. In this way, there is no failure with an input surge.

## Outline drawing

- TYPE I  
PAX35-10  
PBX20-5  
PBX40-2.5
- TYPE II  
PAX35-20  
PAX35-30  
PBX20-10  
PBX20-20  
PBX40-5  
PBX40-10



# Easy-to-operate software expanding functions of power supplies and electronic loading units



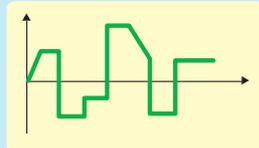
### Features

- 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.  
(RS-232C, GPIB from NI, INTERFACE, and CONTEC)
- Text files can be read freely.

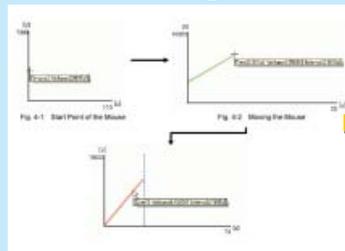
### Waveform images



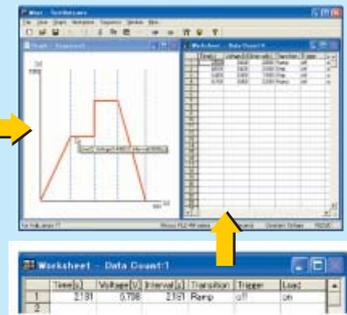
[Example in the PAX Series]



[Example in the PBX Series]



Data created with a mouse is displayed as shown on the right.



\* When adding data, you can also enter the data directly in data cells.

**We can meet other customized requests. Please feel free to contact us.**

\* WAVY for PCR-L, WAVY for PLZ-3W, and WAVY for PAD-LET are also available!



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