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<i>PAV120Bi</i> <i>POWER AMPLIFIER USER MANUAL</i>

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1. Safety Precaution

Read User Manual before operation.

1. Check carefully all buttons are positioned correctly before startup.
 - 1) Pause button in correct position in pressed state.
 - 2) ON/OFF in OFF state.
 - 3) Not press high power button (High power indicator in OFF state)
2. Main supply capacity should meet the requirement; otherwise it will affect output power of amplifier during high current output.
3. Handle the amplifier with great care and follow the symbols on the package: fragile, handle with care, top (an arrow pointing up), keep dry and protect from shaking.
4. Generally it's not necessary to depress high power button (high power button light should be off also).
5. Never operate live signal and load wires with voltage or current output to protect the safety of equipment and personnel.
6. In case the power outlet for powering up the amplifier does not have protective ground customer must connect the ground socket to the protective ground at the test site
7. The voltage output of over 36V is considered as dangerous and care must be taken
8. It's not allowed to feed external voltage into the voltage/current output sockets
9. It's not allowed to feed external current into the current/voltage output sockets
10. Disconnect the external circuit from the relay to avoid any influence to the test
11. Do not block the ventilation outlets
12. Avoid the equipment to be wet by rain
13. Do not switch-on and operate the equipment in the place having explosive gas or water

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vapor.

14. The 500V dangerous voltage can be in the equipment and please don't remove the cover by yourself
15. Please contact the manufacture for any maintenance
16. The guarantee will become invalid if kit is opened by the customer.

For Your Safety Please Note

 This symbol indicates potential hazards by electrical voltages/currents caused by, for example, wrong connections, short-circuits, technically inadequate or faulty equipment or by disregarding the safety notes of the following sections.

Use Proper Power Cord

Only the power cord designed for the instrument and authorized by local country could be used.

Ground The Instrument

The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, it is essential to connect the earth terminal of power cord to the Protective Earth terminal before any inputs or outputs.

Observe All Terminal Ratings

To avoid fire or shock hazard, observe all ratings and markers on the instrument and check your manual for more information about ratings before connecting.

Do not Assemble/Disassemble the Instrument without Authorization

The instrument should be assembled and or disassembled by professional engineers; users are not allowed to perform related operations except for some possible replacements in this

manual.

Do not Move or Maintain the Instrument When it is Powered On

To avoid personnel injuries, any position adjustment, maintenance or parts replacement are forbidden when instrument is on.

Use Proper Fuse

Please use the specified fuses.

Do Not Operate With Suspected Failures

If you suspect damage occurs to the instrument, have it inspected by qualified service personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or accessories must be performed by authorized personnel.

Keep Well Ventilation

Inadequate ventilation may cause increasing of temperature or damages to the device. So please keep well ventilated and inspect the intake and fan regularly.

Do Not Operate in Wet Conditions

In order to avoid short circuiting to the interior of the device or electric shock, please do not operate in a humid environment.

Do Not Operate in an Explosive Atmosphere

In order to avoid damages to the device or personal injuries, it is important to operate the device away from an explosive atmosphere.

Keep Product Surfaces Clean and Dry

To avoid the influence of dust and/or moisture in air, please keep the surface of device clean and dry.

Operate the Instrument in a Suitable Environment

The best condition for optimal measurement is: 5 °C to 40°C; less than 2 °C/hour changing, 20% to 80% RH and the instrument should not be placed towards the air outlet.

Electrostatic Prevention

Operate in an electrostatic discharge protective area environment to avoid damages induced by static discharges. Always ground both the internal and external conductors of the cable to release static before connecting.

Proper Use of Solvent

Please use the solvent in compliance with instructions specified in its supplier. If necessary, wear protective clothing, gloves and glasses to avoid any injuries.

Handling Safety

Please handle with care during transporting to avoid damages to surface, panel and parts

resulting from the falling from your hand.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2. General

The power amplifier for digital simulator in power system is required to have high linearity, quick response, be available to all kinds of capacitive, inductive and resistive loads. Generally power amplifier consists of two types of amplifiers: linear power amplifier and switching power amplifier. The linear power amplifier has the strengths of high linearity, quick response, high accuracy, good electromagnetic compatibility and the weakness of bad performance in high current and high power cases. The switching power amplifier is quite fit in high current, high power devices with its strength of high efficiency, but it's weak in linearity, small signal noise, DC offset, drift, transient response, load driving capability aspects, which are very difficult to fix.

PAV120Bi is specially designed for R&D of power system simulation. It is adapt to various capacitive and inductive load. There are 6-phase voltage outputs with max. 120VRms per phase and max. output power 60VA..

3. Main Technical Specifications

3.1 Power Supply

Model	PAV120Bi
Item	
Power supply	3-phase 380V $\pm 10\%$ 50/60Hz
Power capacity	750VA

3.2 Environment Conditions

Temperature: 25°C $\pm 10^\circ$ C

Related humidity: 20%RH—85%RH

Pressure: 86 kPa—106kPa

Surrounding conditions: No dust, vibration or serious electromagnetic field interferes

3.3 Dimension and Weight

4U standard chassis HxWxD(mm): 177x445x455

Weight:20kg

3.4 Technical Specifications

Voltage output	6x0 ~ 120V RMS
Max. output power	> 60VA (120V output)
Input signal	0 - 7V RMS
Voltage accuracy	< 0.2% (5V-120V)
Typical voltage accuracy	<0.1%
Differential input impedance	20k Ω
Gain	20V/1V
THD	\leq 0.2%
Linearity	\leq 0.1%
Phase accuracy	0.2 $^{\circ}$
Frequency range	DC-5kHz \pm 1dB
Step response	< 20 μ s
Input/output time delay	< 20 μ s
Power supply	3-phase 380V \pm 10% 50/60Hz

4. Functions and Features

4.1 Basic Principle

PAV120Bi consists of the below parts mainly:

- a) High-speed differential input circuit for amplifier;
- b) Voltage power amplifier module;
- c) Detection and alarm circuit: each amplifier has an output distortion detection circuit.
- d) Temperature protection circuit: Turn off the amplifier when the temperature is too high; It will resume working when it is cooled down to a reasonable degree.
- e) Cooling fan: when the temperature is quite low, the fan will work at a low speed for prolonging the fan's life-span and reducing working noise.

4.2 Functions and Features

4.2.1 Differential input circuit

The differential input circuit can reduce the influence of the common mode noise to make it possible that use long wires to connect across the amplifier and signal source, which will reduce mutual effects between all amplifiers during output to guarantee the operation safety of the simulator.

4.2.2 Over-load alarm function

The output voltage distortion and overload auto-detection circuit will protect the voltage amplifier output overload or short-circuit automatically. It automatically closes amplifier input/output, and the overload alarm in rear panel lights. After overload and short-circuit disappear, it restores to working status.

4.2.3 Pause control function

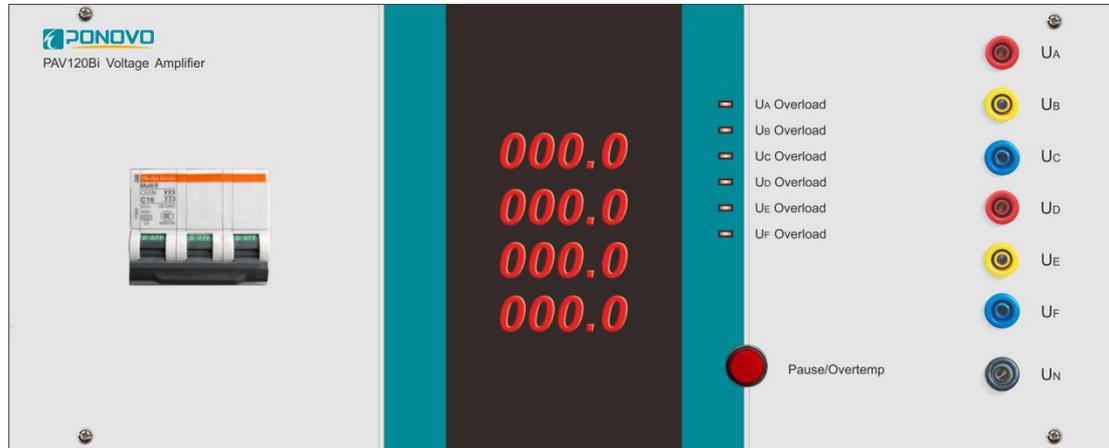
The pause button on the front panel can cut off the amplifier's signal output. The Pause indicator will be on and the Run indicator will be off after pressing the Pause button. The output of amplifier is turned off.

4.2.4 Overheat protection function

When the overheat protection is activated, the amplifier will stop working automatically and the "Overtemp" indicator will be on and it sends off alarm.

4.3 Panels

4.3.1 Front Panel



Switch: Power On/Off

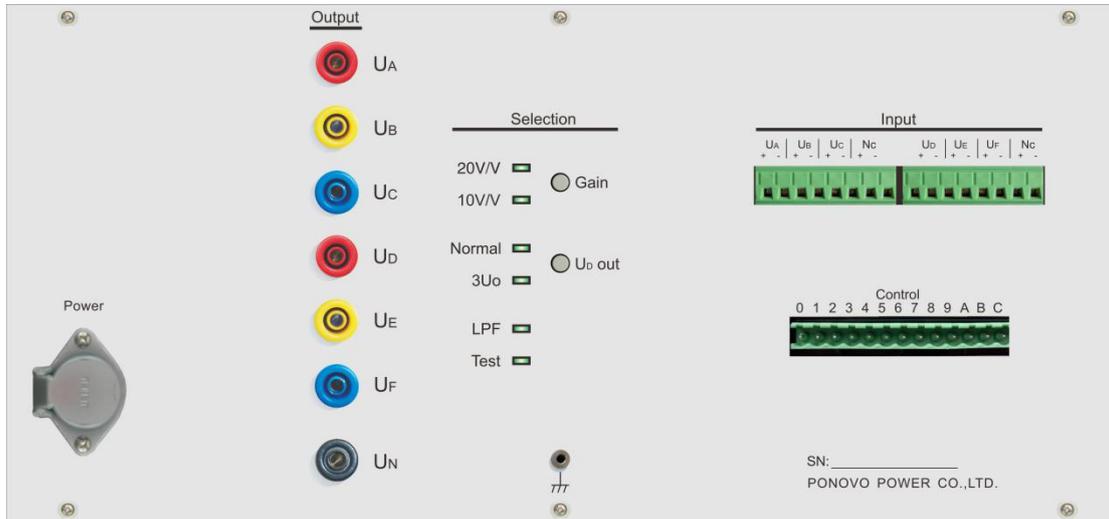
Display: Show the voltage value

Overload indicators: Each indicator is related to each output.

Pause/Overtemp indicator/button: Press it for pause the output and light on; Or overtemperature light on.

Output: 4mm banana socket connected to output voltage.

4.3.2 Rear Panel



Power: Power supply socket

Output: the same as the output in the front panel.

Selection



Gain: Select the voltage gain 20V/V or 10V/V.



U_o out: Select the suitable U_o output way.

Normal: It outputs normally based on the input signal.

3U_o: It outputs zero sequence voltage based on the UA/UB/UC calculation result.



LPF: Low-pass filter. A low-pass filter (LPF) is a filter that passes signals with a frequency lower than a selected cutoff frequency and attenuates signals with frequencies higher than the cutoff frequency. The output response time is delayed around 200us.

Please refer to the **Control definition** below for more details.

Test: It is used for calibration purpose. When the calibration signal is input, all the outputs will be the same for calibration convenience.

Please refer to the **Control definition** below for more details.

Earth grounding (if it is installed in the cabinet, no grounding connection is required.): It should be connected earth grounding in separate operation.

Input: Low level voltage input.

Control definition

Terminal No.	0	1	2, 3	4	5	6	7	8	9, A, B, C
Function Definition	Low pass Filtering +12V	Low pass filtering -	NC	Test signal input +	Test signal GND	Test control +12V	Pause control +12V	Pause control -	NC

5. How to Use Amplifier

5.1 Wiring

Connect digital simulator system's D/A output signals to corresponding signal channels of voltage input (Refer to the Definition of terminal leads). Pay attention that the shielded layer of the signal wire at simulator side should be grounded.

5.2 Running

Check the power supply is normal before energizing the amplifier and the polarity of input signal is correct. After all points are confirmed correctly, turn on the amplifier, the power supply indicator will light and run indicator will flicker. It indicates the amplifier works normal.

5.3 Voltage Output

First, press "Pause" button and connect the voltage output terminals to corresponding terminals of the tester respectively. And then inactivate the pause function and input simulation signal, the amplifier will work under voltage amplifying status.

The formula is : Voltage output = Input simulation signal x gain

Notes: 1. never operate live signal and load cables with voltage or current output to protect the safety of equipment and personnel.

5.4 Amplifier Off

Stop simulation signal input firstly if users stop using amplifier. Press “Pause” buttons, and cut off all connections of amplifier and load, lastly turn off power.

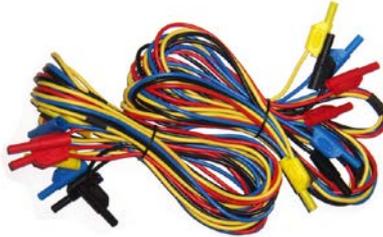
5.5 Amplifier Test Items

Before putting into market, the amplifier is required to have strictly inspections. The test items are: function inspection, linearity, load stability, THD, max output power, amplitude-frequency characteristic, input/output delay and step response, etc.

Please refer to Factory Test Report for the detailed information.

6. Cables

Colour coded voltage cables



SAW0202 colour coded voltage cable

Amount: 8 pieces

The voltage cables to connect the amplifier output to other safety sockets of, generally the voltage parts.

7. Parameter definition

Notes: The voltage/current values are valid if not specified.

- 1) Output calculation value: input signal RMS x gain value

For example: $1.0V \times 50.0V/V = 50.0V$

- 2) Measured output value: the effective value of actual output
- 3) Relative error:

$$\frac{\text{Measured output value} - \text{output calculation value}}{\text{Output calculation value}} \times 100\%$$

- 4) Linearity:

$$\frac{\text{Max. positive error} - \text{max. negative error}}{2}$$

- 5) Voltage amplifier load stability: No-load voltage U1 50% rated load U2

$$\frac{U1 - U2}{\text{Output calculation value}} \times 100\%$$

- 6) Input/output delay: the time delay of 50% rising rate between input square wave signal and the output square wave signal
- 7) Amplifier step response: the bigger value between the time of 10%-90% rising rate and 90%-10% falling rate