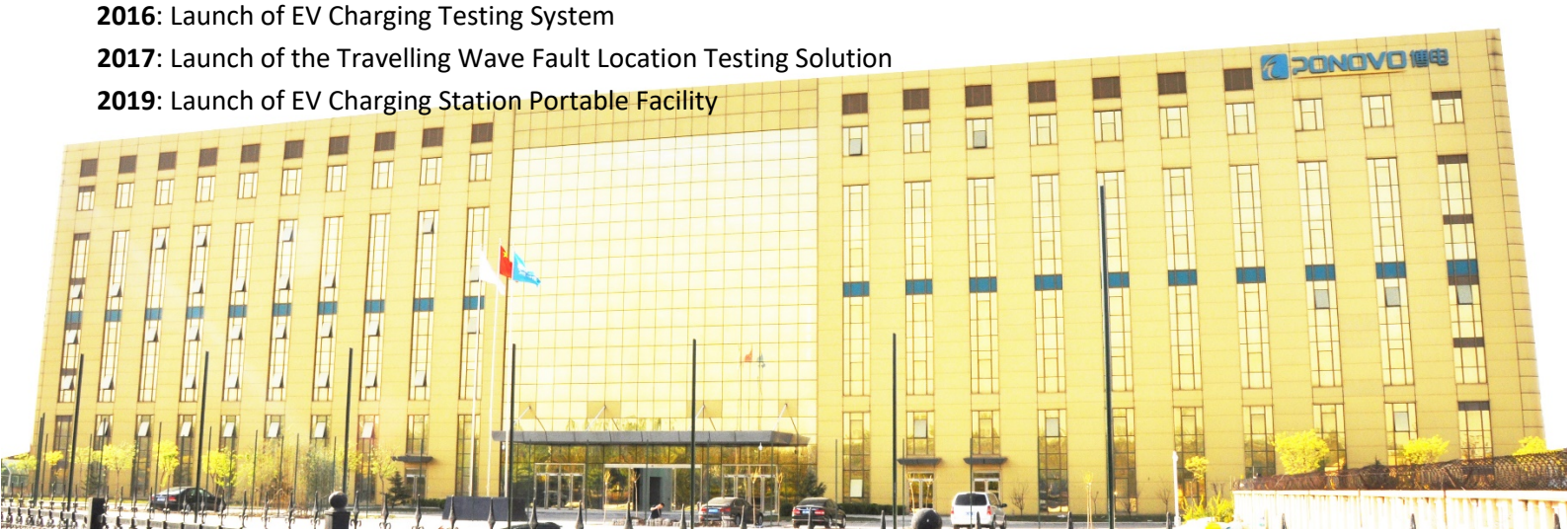
PAV Series
4-Quadrant Power Amplifier

PONOVO POWER CO., LTD.
www.ponovo.net

About us

Throughout the last decade, PONOVO POWER CO., LTD. (previously known as Power Advanced Co., LTD.) has been focusing on providing professional solutions to over 5000 clients in the fields of intelligent testing and power quality control.

2001: Foundation of PONOVO POWER CO., LTD.
2001: Launch of PWA, the relay test system with in-built output monitoring and recording function
2002: Launch of PW466A, the relay test system with 6 currents and 6 voltages
2003: Launch of PH01, the testing system for Traveling Wave Fault Locater
2004: Launch of PWS, the relay test system for subway used protective relays
2005: Launch of PWF, the relay test system for digital substation with IEC61850 protocol
2005: Launch of e40, the software for automatic test and management
2006: Launch of the relay test system for serial compensation system used relays
2007: Launch of PM605A, the universal calibrator and test system
2008: Launch of T200A, the single phase universal tester which can provide 120s output time at 250A
2008: Launch of MR1200, the portable disturbance recorder with in-built oscilloscope function
2008: Launch of PowerTest relay test software
2009: Launch of the relay test system for 500KV DC converting station test application
2009: Launch of L336i, the compact relay test system with 6 currents and 4 voltages and has a weight of 8.6kg
2009: Launch of PCT100i, the CT/PT tester with a weight of 11 kg
2009: Launch of HB-6000, the online DGA (dissolved gas analyzer) system for transformer
2009: Launch of PF3000, the test system for automatic test of power filters
2009: Launch of T1000/T2000, the primary injection kit which can provide 120s output time at 1000A
2009: Launch of TD4000A, which can continuously supply 4000A DC current for testing DC type CT
2010: Launch of PCT200i, new generation of CT\PT Tester
2010: Launch of PNS series handheld digital signal analyzer for intelligent substation maintenance
2010: Launch of new generation NF801 portable fiber digital relay tester with 8 fiber optical ports
2012: Launch of Merging Unit (MU) Tester
2012: Launch of NF802 Intelligent Relay Tester
2013: Launch of PNS610 digital signal analyzer
2014: Launch of PW40i, new 3-phase relay test set specially for G59 testing solution
2014: Launch of PNA1000, 24hours online monitor and analyzing system for digital substation
2014: Launch of the PNS630, new touch-screen handheld network analyzer based on IEC61850
2015: Launch of the New Modular Analog-Digital Protection Relay Tester
2016: Launch of PAV series, 3-phase 4-Quadrant amplifier system
2016: Launch of EV Charging Testing System
2017: Launch of the Travelling Wave Fault Location Testing Solution
2019: Launch of EV Charging Station Portable Facility



PAV Series 4-Quadrant Power Amplifier

Introduction

PAV Series Four-quadrant Simulation Power Amplifier based on linear power amplifier technology and integrated advanced technical performance and rich functions.

It is vastly used by the institutes in the area of power, new energy, aerospace, rail transport, mining, petrochemical etc.

It is also the ideal R&D device of wind power, PV, electric car, large power charging device, aerospace power system, marine power system, distribute energy, micro grid etc.

It can directly connect to the popular simulation platform eg: OPAL-RT, RTDS, etc.

Features

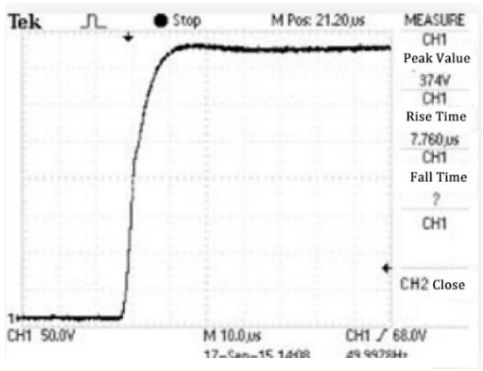
- Extremely low harmonic distortion - Even under very non-linear load conditions
- Very fast slew rate> 50V/μs
- Short Input/Output delay: < 10μs
- Wide frequency range:DC-5kHz
- High input impedance
- High output precision
- High accuracy output
- Special port for power interactive simulation in 4-quadrant
- Support optical digital communication with PHIL interface via AURORA protocol
- Dual-gain to work smooth with different simulations
- Measurement, monitor and protection functions
- High long-term overload characteristic (up to 1-hour)
- High short-term overload characteristic (for 5-10mins)

Application

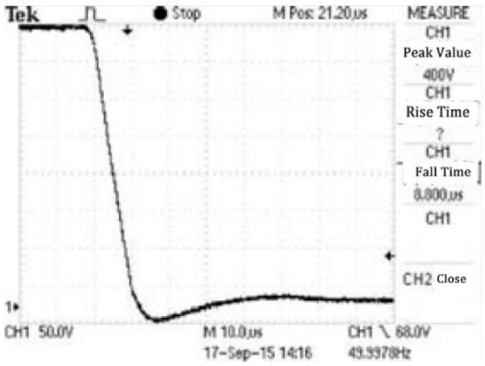
- The distributed energy system such as photovoltaic power generation, wind generation, energy storage battery and fuel cell system etc.
- The microgrid
- The electromobile and charge unit
- The energy storage
- Railway transportation
- The aerospace
- The electric system detection
- The hybrid simulation in power system
- HVDC
- FACTS
- HVDC and HVAC connection
- Dynamic load analysis on AC, etc.

Super Fast Rise and Fall time

PAV series 4-quadrant amplifiers has very fast rise and fall rate, which is >50V/us



Rise time of the output voltage

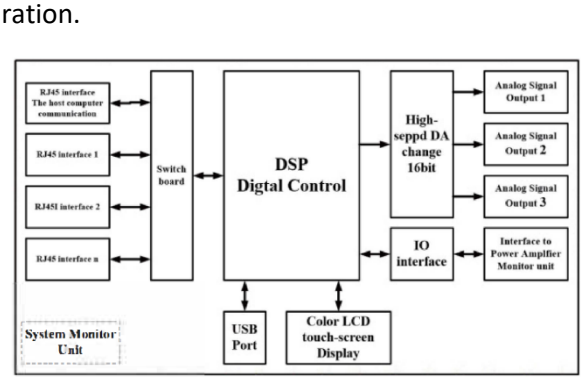


Fall time of the output voltage

User-friendly Designed System Monitor Unit

System monitor unit could be used to control and display the status of each module of the power amplifier. It could also be capable to output high-accuracy DC simulation signal to 3-phase power amplifier units.

The system monitor unit is user-friendly designed with high-speed DSP control and Color LCD touch-screen for operation.

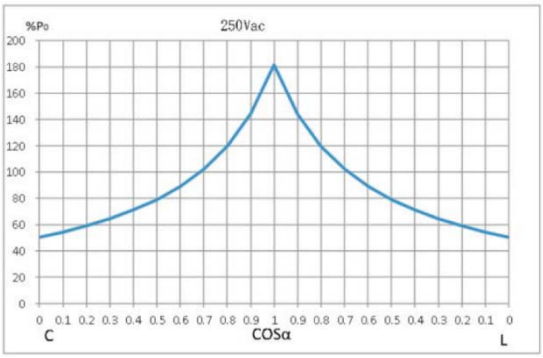


System Monitor Unit Design Principle Diagram

High Loadability

PAV amplifier's output power could reach 150% rating on a real load.

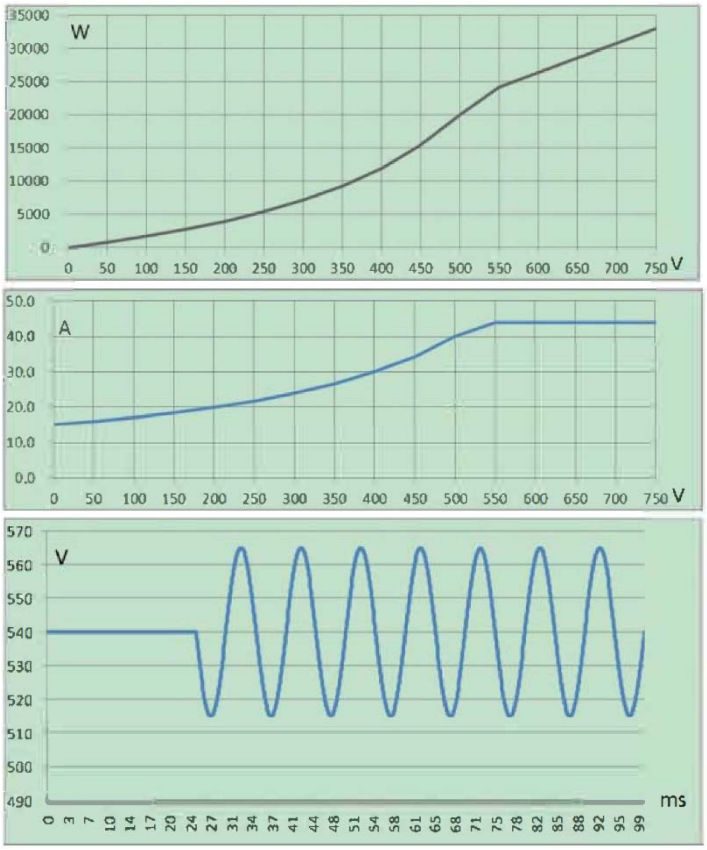
Whether operating with inductive or capacitive loads, PAV amplifier could guarantee its stability.



DC Output Application

As well as AC outputs, DC signals could be easily generated by PAV amplifiers.

PAV30kD 4-quadrant 3-phase DC Power Amplifier output characteristic curve



DC superimposed AC Low-level Signal characteristics

Specifications 1

Item	PAV3000	PAV5000	PAV7500
Nominal voltage			
AC	270V (135V optional)	270V (135V optional)	270V (135V optional)
DC	±382V (±191V optional)	±382V (±191V optional)	±382V (±191V optional)
Line regulation	$1.5x10^{-4}$ /10V	$1.5x10^{-4}$ /10V	$1.5x10^{-4}$ /10V
Gain	40V/V or 25V/V	40V/V or 25V/V	40V/V or 25V/V
Gain Stability (const load & Temp.)	±0.1%/5min	±0.1%/5min	±0.1%/5min
Frequency range			
Bandwidth range	DC-5kHz(±1dB)	DC-5kHz(±1dB)	DC-5kHz(±1dB)
Small signal (3%)	DC-50kHz(±3dB)	DC-50kHz(±3dB)	DC-50kHz(±3dB)
Harmonic distortion			
45-450Hz (Typ./Max)	0.05%/0.2%	0.05%/0.2%	0.1%/1%
450-5kHz	0.6% typ. ,1% guar.	0.6% typ. ,1% guar.	0.6% typ. ,1% guar.
Input			
Signal range (analog signal)	0-±10V(40V/V) or 0-±16V(25V/V)	0-±10V(40V/V) or 0-±16V(25V/V)	0-±10V(40V/V) or 0-±16V(25V/V)
Digital signal interface	Communication interface with fiber optic ports, supporting AURORA protocol	Communication interface with fiber optic ports, supporting AURORA protocol	Communication interface with fiber optic ports, supporting AURORA protocol
Impedance	10kΩ	10kΩ	10kΩ
Input/Output delay	10us	10us	10us
Power AC (Nominal voltage 270V)	3kVA	5kVA	7.5kVA
Power DC (Nominal voltage ±382V)	3kW	5kW	7.5kW
Long-time overload (1 hour)	4.5kVA	7.5kVA	11.25kVA
Max. short-time power	6kVA	10kVA	15kVA
Max. sink power	30% Rated output power	30% Rated output power	30% Rated output power
Measurement range			
Voltage	0-300V	0-300V	0-300V
Current	0-24A	0-40A	0-60A
Accuracy of voltage measurement	0.5%RG	0.5%RG	0.5%RG
Accuracy of current measurement	0.5%RG	0.5%RG	0.5%RG
Accuracy of power measurement	0.5%RG	0.5%RG	0.5%RG
Protection	Overload/short-circuit/overheat	Overload/short-circuit/overheat	Overload/short-circuit/overheat
Digital monitoring unit			
Analog output	0-±10V or 0-±16V	0-±10V or 0-±16V	0-±10V or 0-±16V
Signal accuracy	AC: 0.03%RG+0.1% @0.5-6.75V 0.1%RG+0.5% @0.1-0.5V DC: 0.03%RG+0.1% @0.5-9.55V 0.1%RG+0.5% @0.1-0.5V	AC: 0.03%RG+0.1% @0.5-6.75V 0.1%RG+0.5% @0.1-0.5V DC: 0.03%RG+0.1% @0.5-9.55V 0.1%RG+0.5% @0.1-0.5V	AC: 0.03%RG+0.1% @0.5-6.75V 0.1%RG+0.5% @0.1-0.5V DC: 0.03%RG+0.1% @0.5-9.55V 0.1%RG+0.5% @0.1-0.5V
Frequency output range	0-5000Hz	0-5000Hz	0-5000Hz
Frequency accuracy	Accuracy (DC): 15Hz-450Hz, ±0.02Hz 450Hz-2000Hz, ±0.1Hz 2000Hz-5000Hz, ±0.15Hz	Accuracy (DC): 15Hz-450Hz, ±0.02Hz 450Hz-2000Hz, ±0.1Hz 2000Hz-5000Hz, ±0.15Hz	Accuracy (DC): 15Hz-450Hz, ±0.02Hz 450Hz-2000Hz, ±0.1Hz 2000Hz-5000Hz, ±0.15Hz
Selectable waveforms	DC, sine, (square, triangle, sawtooth, step, optional)	DC, sine, (square, triangle, sawtooth, step, optional)	DC, sine, (square, triangle, sawtooth, step, optional)
Power supply	3 Phase 380V/208V±10%, 50/60±5Hz	3 Phase 380V/208V±10%, 50/60±5Hz	3 Phase 380V/208V±10%, 50/60±5Hz
Power protection	Short-circuit, default-phase alarm	Short-circuit, default-phase alarm	Short-circuit, default-phase alarm
Dimensions			
Cabinet (W x D x H)	650mmx900mmx2100mm, 43U	650mmx900mmx2100mm, 43U	650mmx900mmx2100mm, 43U
Power amplifier unit	19", 5U	19", 5U	
Digital monitor unit	19", 4U	19", 4U	19", 4U
Power supply unit	19", 12U	19", 12U	19", 12U
Weight	450kg	450kg	3x450kg

Note: The default frequency is 50Hz/60Hz except for the explicitly indicated frequency.

Specifications 2

Item	PAV10000	PAV15000	PAV20000
Nominal voltage			
AC	270V (135V optional)	270V (135V optional)	270V (135V optional)
DC	±382V (±191V optional)	±382V (±191V optional)	±382V (±191V optional)
Line regulation	$1.5x10^{-4}$ /10V	$1.5x10^{-4}$ /10V	$1.5x10^{-4}$ /10V
Gain	40V/V or 25V/V	40V/V or 25V/V	40V/V or 25V/V
Gain Stability (const load & Temp.)	±0.1%/5min	±0.1%/5min	±0.1%/5min
Frequency range			
Bandwidth range	DC-5kHz(±1dB)	DC-5kHz(±3dB)	DC-5kHz(±3dB)
Small signal (3%)	DC-50kHz(±3dB)	DC-50kHz(±3dB)	DC-50kHz(±3dB)
Harmonic distortion			
45-450Hz (Typ./Max)	0.1%/1%	0.1%/1%	0.5%/1.5%
450-5kHz	0.6% typ. ,1% guar.	1% typ. ,2% guar.	1% typ. ,2% guar.
Input			
Signal range (analog signal)	0-±10V(40V/V) or 0-±16V(25V/V)	0-±10V(40V/V) or 0-±16V(25V/V)	0-±10V(40V/V) or 0-±16V(25V/V)
Digital signal interface	Communication interface with fiber optic ports, supporting AURORA protocol	Communication interface with fiber optic ports, supporting AURORA protocol	Communication interface with fiber optic ports, supporting AURORA protocol
Impedance	10kΩ	10kΩ	10kΩ
Input/Output delay	10us	10us	10us
Power AC (Nominal voltage 270V)	10kVA	15kVA	20kVA
Power DC (Nominal voltage ±382V)	10kW	15kW	20kW
Long-time overload (1 hour)	15kVA	22.5kVA	30kVA
Max. short-time power	20kVA	30kVA	40kVA
Max. sink power	30% Rated output power	30% Rated output power	30% Rated output power
Measurement range			
Voltage	0-300V	0-300V	0-300V
Current	0-80A	0-120A	0-160A
Accuracy of voltage measurement	0.5%RG	0.5%RG	0.5%RG
Accuracy of current measurement	0.5%RG	0.5%RG	0.5%RG
Accuracy of power measurement	0.5%RG	0.5%RG	0.5%RG
Protection	Overload/short-circuit/overheat	Overload/short-circuit/overheat	Overload/short-circuit/overheat
Digital monitoring unit			
Analog output	0-±10V or 0-±16V	0-±10V or 0-±16V	0-±10V or 0-±16V
Signal accuracy	AC: 0.03%RG+0.1% @0.5-6.75V 0.1%RG+0.5% @0.1-0.5V DC: 0.03%RG+0.1% @0.5-9.55V 0.1%RG+0.5% @0.1-0.5V	AC: 0.03%RG+0.1% @0.5-6.75V 0.1%RG+0.5% @0.1-0.5V DC: 0.03%RG+0.1% @0.5-9.55V 0.1%RG+0.5% @0.1-0.5V	AC: 0.03%RG+0.1% @0.5-6.75V 0.1%RG+0.5% @0.1-0.5V DC: 0.03%RG+0.1% @0.5-9.55V 0.1%RG+0.5% @0.1-0.5V
Output frequency range	0-5000Hz	0-5000Hz	0-5000Hz
Frequency accuracy	Accuracy (DC): 15Hz-450Hz, ±0.02Hz 450Hz-2000Hz, ±0.1Hz 2000Hz-5000Hz, ±0.15Hz	Accuracy (DC): 15Hz-450Hz, ±0.02Hz 450Hz-2000Hz, ±0.1Hz 2000Hz-5000Hz, ±0.15Hz	Accuracy (DC): 15Hz-450Hz, ±0.02Hz 450Hz-2000Hz, ±0.1Hz 2000Hz-5000Hz, ±0.15Hz
Selectable waveforms	DC, sine, (square, triangle, sawtooth, step, optional)	DC, sine, (square, triangle, sawtooth, step, optional)	DC, sine, (square, triangle, sawtooth, step, optional)
Power supply	3 Phase 380V/208V±10%, 50/60±5Hz	3 Phase 380V/208V±10%, 50/60±5Hz	3 Phase 380V/208V±10%, 50/60±5Hz
Power protection	Short-circuit, default-phase alarm	Short-circuit, default-phase alarm	Short-circuit, default-phase alarm
Dimensions			
Cabinet (W x D x H)	650mmx900mmx2100mm, 43U	650mmx900mmx2100mm, 43U	On request
Power amplifier unit	19", 11U	19", 17U	On request
Digital monitor unit	19", 4U	19", 4U	On request
Power supply unit	19", 12U	19", 12U	On request
Weight	3x450kg	3x450kg	On request

Note: The default frequency is 50Hz/60Hz except for the explicitly indicated frequency.

PONOVO POWER CO., LTD.
No.139 Jinghai Third Road, BDA, Beijing, China. 100176
Tel : +86 {10) 59089666
Fax: +86 (10) 59089999
www.ponovo.net
info@relaytest.com
support@relaytest.com