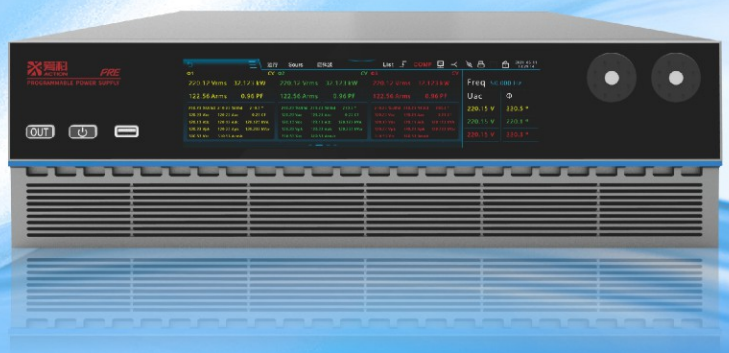
爱科赛博
ACTIONPOWER



PRE

REGENERATIVE GRID SIMULATOR MODEL PRE20

西安爱科赛博电气股份有限公司
XI'AN ACTIONPOWER ELECTRIC CO.,LTD.

Products Review

ActionPower PRE20 models are applied to normal power tests and power grid related tests. The Grid Simulators are a full 4 quadrant, full regenerative, AC power sources designed for common electrical power testing such as home appliances and industrial electronics needing a programmable input source. In addition, it is designed to simulate grid characteristics for testing PV inverter, power conversion systems (PCS) and on-line UPS. It is well known that power can be both sinking and sourcing from the unit under test (UUT) seamlessly to support many different applications. In cases where the UUT generates current, a detection circuit will sense the excess power and feed it back to the grid.

At same time, ActionPower PRE20 models are available with a regenerative AC Load function without any manual option. PRE20 allow for a single device to function as either an AC load or an AC source. Load and source modes are easily selected or switched on the user interface.

ActionPower PRE20 3U high series of regenerative grid simulators include single phase and 3-phase operation. Parallel output for higher power applications, PRE20 can extend the output power when configuring up to 10 units in parallel.

ActionPower PRE20 models are regenerative providing a complete energy saving solution. The power generated by the UUT during the test can be efficiently regenerated to the grid, rather than dissipated as heat, which protects the environment and lowers the cost of operation. With this capability, these models can be applied to applications in green energy products, such as PV inverters, energy storage systems (ESS), power conversion systems (PCS), micro grids, power hardware-in-the-loop (PHIL), electric vehicle power supply equipment (EVSE), on-board charger(OBC) and DC/DC, etc.

For regulatory testing, PRE20 models can be applied to IE+C61000-4-11,4-13,4-14,4-27,4-28(international regulations for AC voltage testing); IEC61000-4-17,4-29 (international regulations for DC voltage testing); IEEE1547/IEC62116 (international regulations related to green power generation), electric vehicle to grid (V2G) testing, electric vehicle to load (V2L) testing, electric vehicle to home (V2H) testing, energy storage system (ESS) testing.

These models are also able to provide precision measurements such as RMS voltage, RMS current, active power, power factor, current crest factor and many others. By applying advanced DSP technology, they can easily simulate power line disturbance (PLD) using LIST, PULSE and STEP modes. Additional features such as the waveform synthesis function allows users to program various distorted harmonic waveform required by some regulatory standards.

Selection

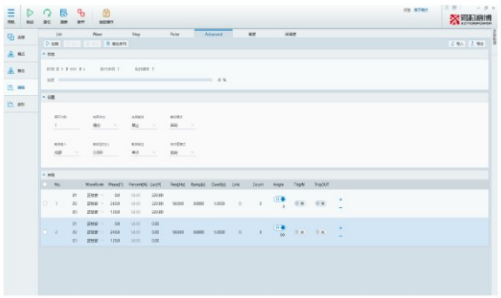
The PRE20 series is currently available in capacities from 6KVA to 20kVA per unit.

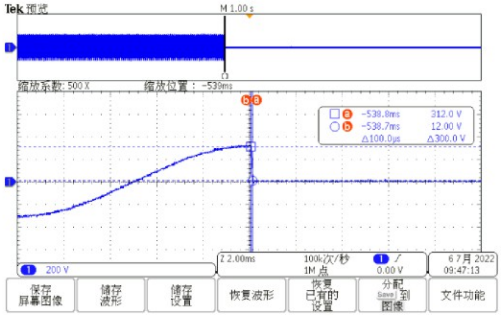
Model	Power (kVA)	Voltage Range (V_rms)	Frequency Range (Hz)	3-Phase/ pre-phase MAXIMUM CURRENT(A)		1-Phase MAXIMUM CURRENT(A)		Voltage Range (V_DC)	Current Range (A_DC)	Shape
				(rms)	(peak)	(rms)	(peak)			
PRE2006S	6	0~450	0.001~200	30	90	90	270	±636	±90	3U
PRE2007S	7.5	0~450	0.001~200	30	90	90	270	±636	±90	3U
PRE2009S	9	0~450	0.001~200	35	105	105	315	±636	±105	3U
PRE2012S	12	0~450	0.001~200	35	105	105	315	±636	±105	3U
PRE2015S	15	0~450	0.001~200	35	105	105	315	±636	±105	3U
PRE2020S	20	0~450	0.001~200	35	105	105	315	±636	±105	3U

Advantages

- **High-dynamic**

PRE20 models: Voltage slew rate ⩾3.0V/us.



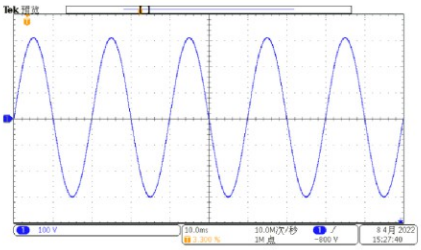


AC220V/50Hz 90°voltage fall, fall time 100μs@90%-10%

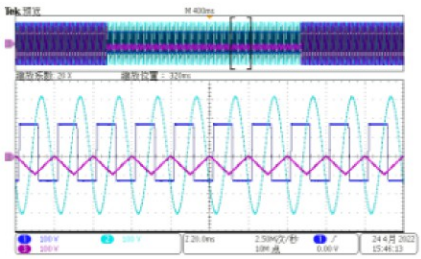
Advantages

- **Output mode**

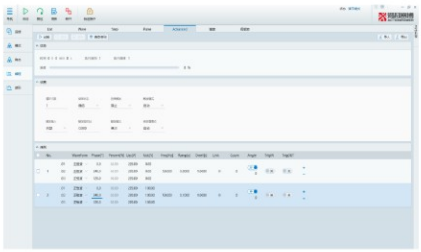
PRE20 models are available in four output modes: AC, DC, AC+DC, DC+AC

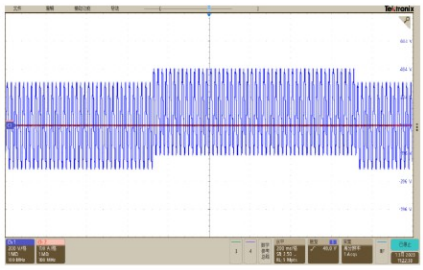


220V@50Hz waveform

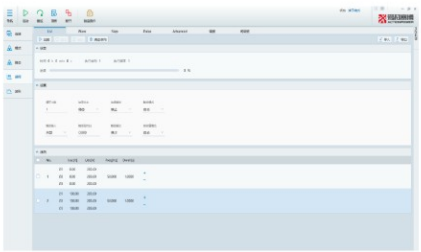


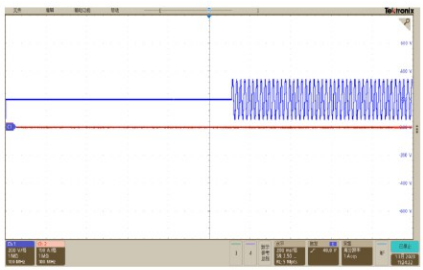
Three phase output different waveform





AC+DC: 220V/50Hz + 100VDC, 0° trigger





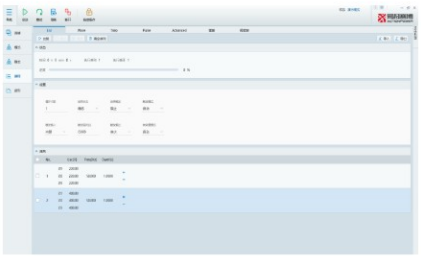
DC+AC: DC200 + AC100V

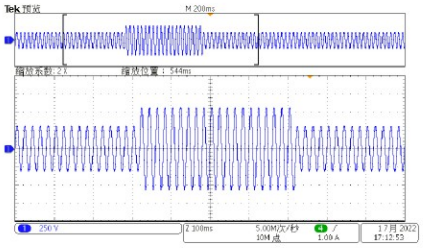
Waveform synthesis function

PRE20 models can easily simulate power line disturbance (PLD) using List, Wave, Step, Pulse, Advanced modes; PRE20 models support 100 groups of customization waveform programming.

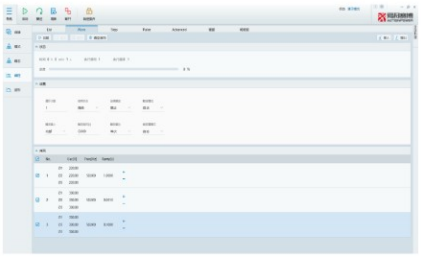
The synthesis function allows users to create periodic harmonic voltage waveform up to 100 orders based on a 40-70Hz fundamental frequency. The Inter-harmonic function allows users to perform frequency sweeps ranging from 0.01Hz to 5000Hz on top of the 50/60Hz fundamental frequency. This special function assists users in locating resonance points. The Harmonic measurement function can measure 50th order harmonics of voltage or current and display values such as fundamental voltage, DC component, and total harmonic distortion.

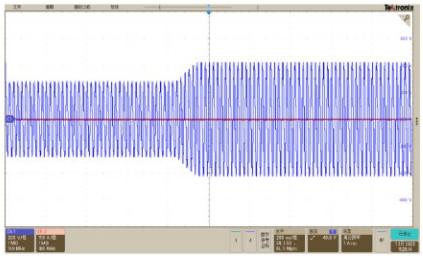
Waveform synthesis function



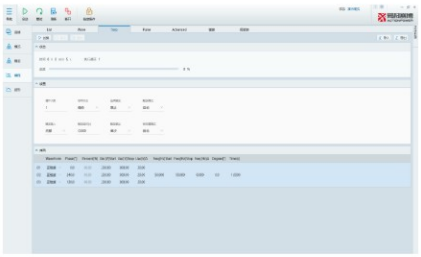


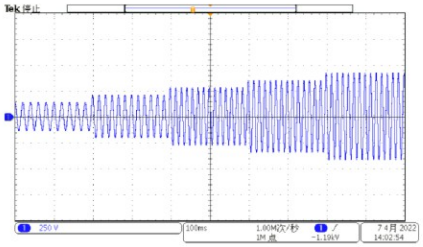
List Model



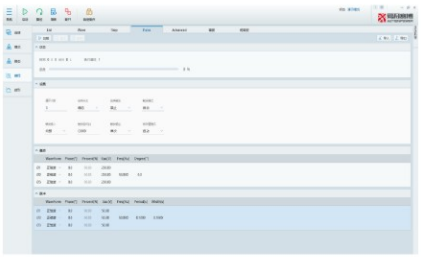


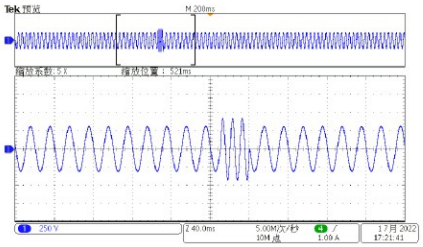
Wave Model





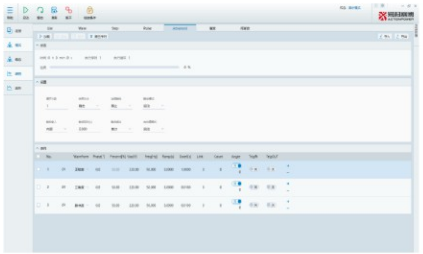
Step Model

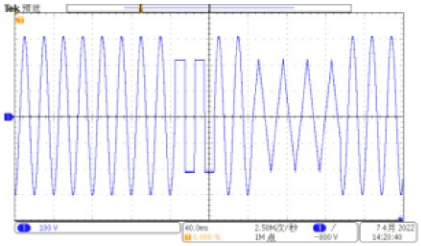




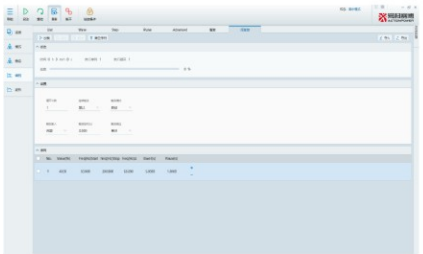
Pulse Model

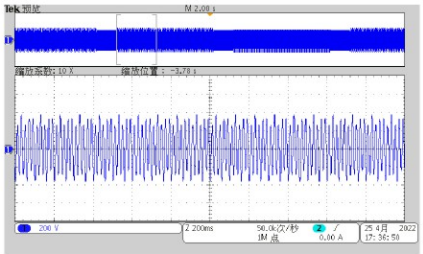
Advantages





Advanced Models



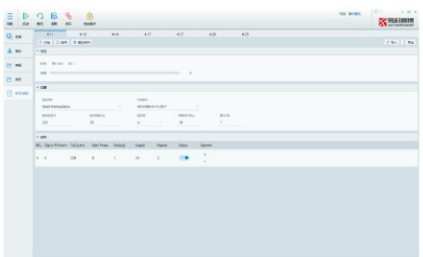


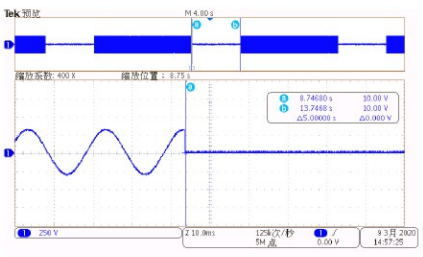
Inter-harmonic Function

- **Complete library of waveforms**

PRE20 models can be applied to 1741SA, IEEE1547, IEC62116, NB/T32004, T/CPSS1007-2020 (International regulations for AC voltage testing).

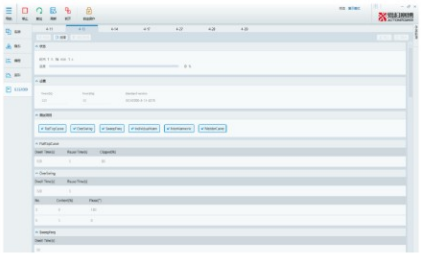
30 DST waveform are built in, which can be called with one key for harmonic injection test of related standards.

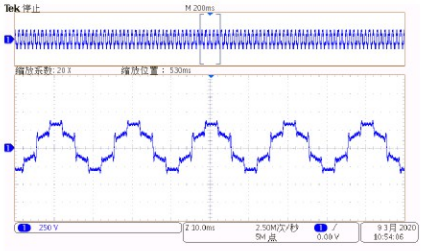




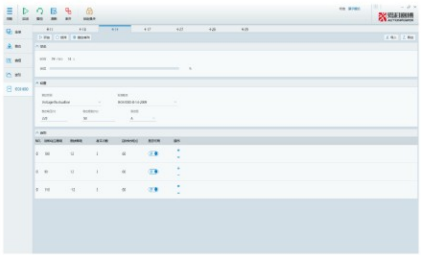
IEC61000-4-11 Interrupt 90°@Class2/50Hz

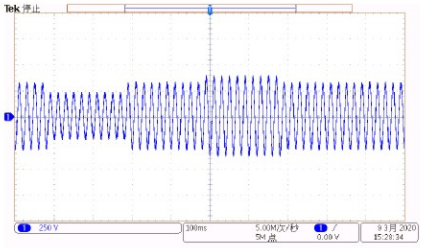
Advantages



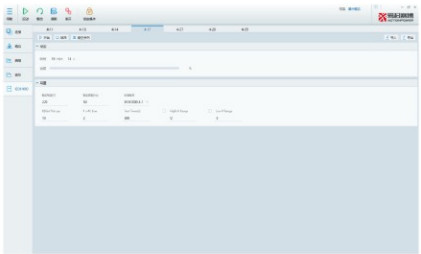


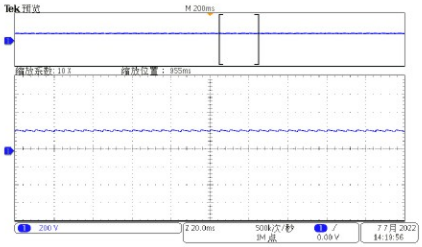
IEC61000-4-13 Non3-multiple odd harmonic @Class3/50Hz



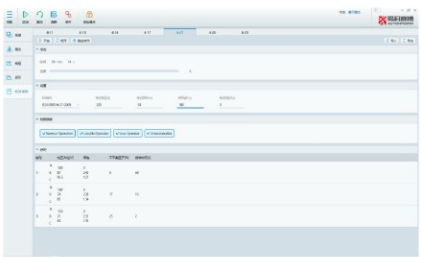


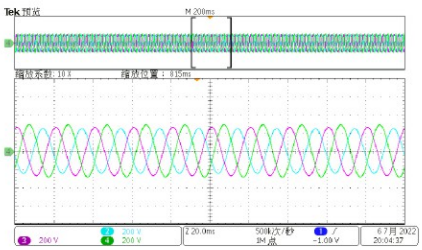
IEC61000-4-14 + 20%-30% voltage fluctuation time interval 0.2s @Class3/50Hz





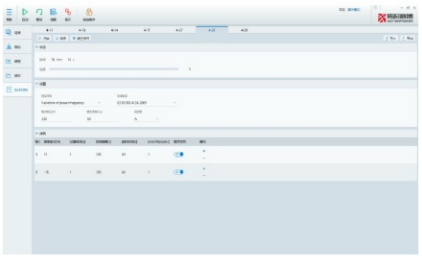
IEC61000-4-17 DC ripple voltage @Class3

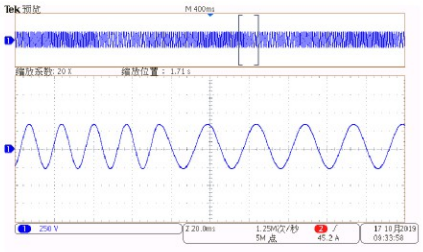




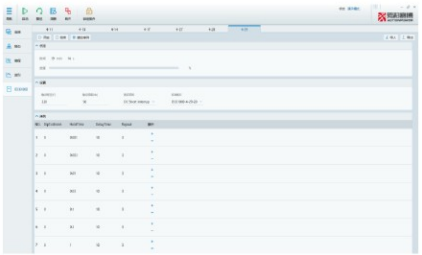
IEC61000-4-27 three-phase voltage unbalance @Class3

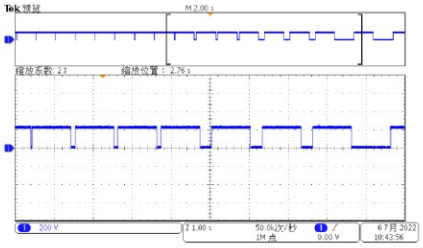
Advantages





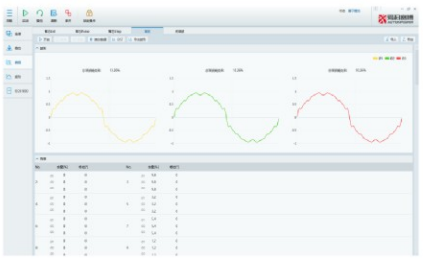
IEC61000-4-28 frequency fluctuation @Class4

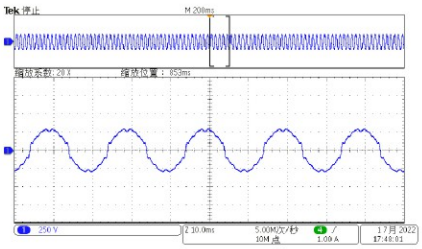




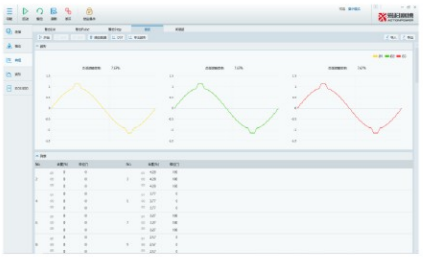
IEC61000-4-29 DC interrupt

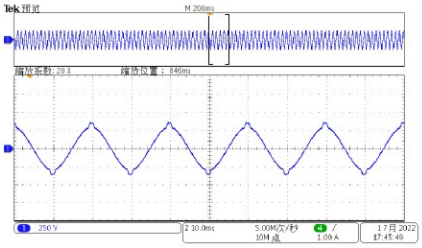
Advantages



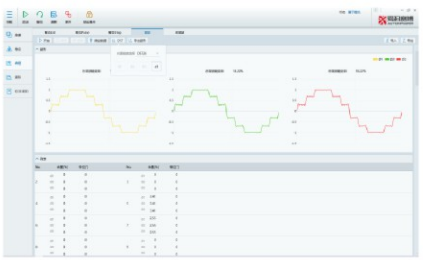


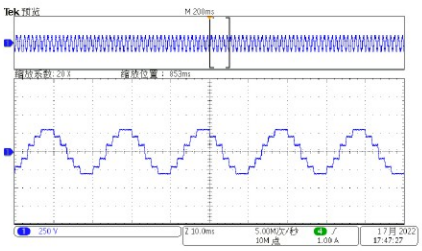
DST10 waveform





DST23 waveform





DST26 waveform

Advantages

- **Internal impedance simulation of RL**

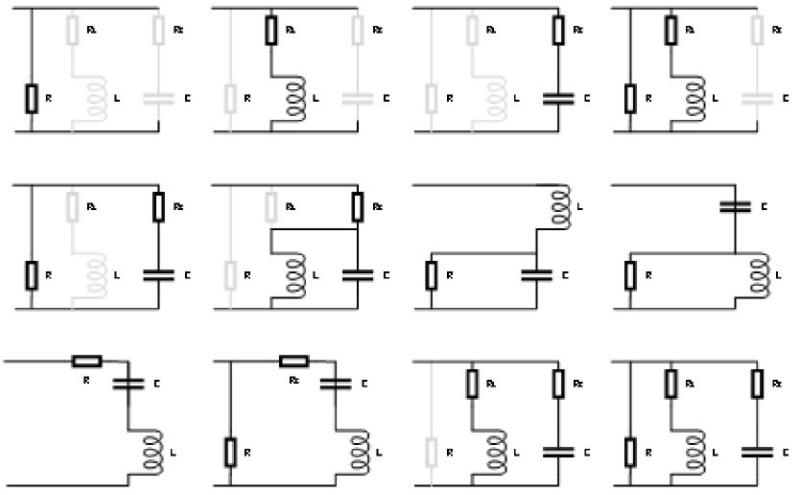
PRE20 models are integrated with R and L impedance simulation functions, so that the output voltage and current are associated with R and L parameters, to simulate the cable impedance functions in IEC61000-3-2, 3-3 standards.

- **Regenerative AC line Load**

In addition to the power supply function, RRE20 models can also realize linear load simulation function, and power back to the grid, so as to achieve multi-purpose.

The PRE20 series has up to 12 built-in RLC network models with flexible parameters to simulate linear load characteristics and fully validate product performance tests under different impedance, three-phase balanced and unbalanced load modes.

For products requiring off-grid testing, such as BOBC, UPS, ESS, etc., the RLC load function of PRE20 series can be used to realize the source-on-load function conversion of a device, greatly simplifying the ATE hardware configuration, and simultaneously realizing V2G, V2L, V2H and other tests.



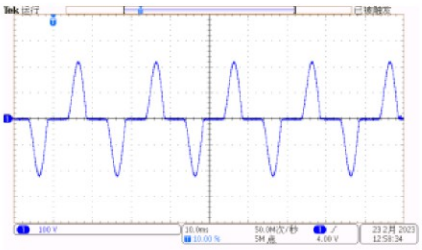
RLC load models

Advantages

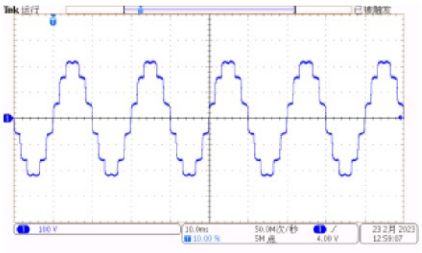
- **Regenerative AC nonlinear Load**

PRE20 regenerative AC load function includes constant current, constant power, and constant impedance modes. An additional setting parameter is crest factor (CF) and power factor (PF). Rectified Mode can simulate the characteristics of a rectified load by setting the CF from 1.414 to 5, providing a non-sinusoidal loading function.

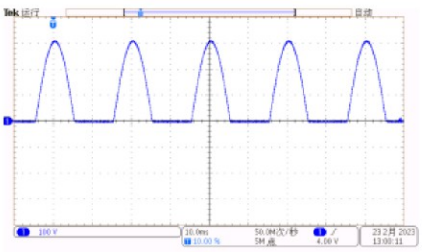
Standards waveform are built in, which can be called with one key for AC load test of related standards. Include 2 pulse wave, 6 pulse wave, 12 pulse wave, 18 pulse wave, 24 pulse wave, positive half wave, negative half wave, leading half wave and trailing half wave.



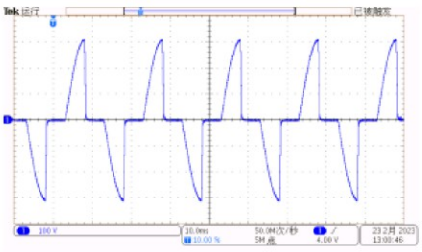
2 PULSE WAVE



12 PULSE WAVE



LEADING HALF WAVE



TRAILING HALF WAVE

Advantages

- **Power hardware-in-the-loop simulation(PHIL)**

PRE20 has extremely high dynamic response and bandwidth, with small signal bandwidth of 10kHz, large signal bandwidth of 2,000Hz and response of 70 μs. It can amplify and output the signals of simulation system, signal source or control card to the tested object, and realize the PHIL function.

Schematic Diagram of PHIL

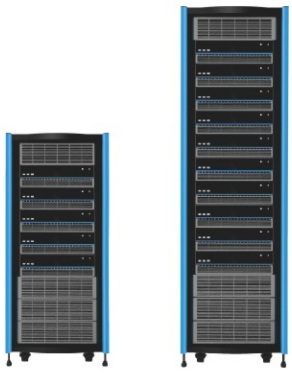
Dimensions

PRE20 models conform to a standard 19" chassis configuration and can be used in standard cabinet systems or desktop applications.

The single module dimensions are 435mm×132mm×781mm (W×H×D) and the appearance is as follows:

Cabinet	Dimensions (W*D*H) (mm)	Range of applications
26U	600×800×1338	For 2-5 power supplies in parallel
42U	600×800×2050	For 5-8 power supplies in parallel

Two parallel cabinets available: PRE-26U、PRE-42U



26U cabinet 42U cabinet

Specification

Technical items		Specification
	Output mode	AC, DC, AC+DC, DC+AC
	Working mode	Bidirectional type source
	Number of phases of output	Single-phase, three-phase, three phases independent
AC Output		
Voltage	Resolution (V)	0.01
	Accuracy ①	±(0.01%+0.05% F.S.)
	Waveform type	Sine wave, triangular wave, pulse wave, clipping, half wave, multi-pulse wave, 30 groups of DST, user-defined wave
	DC component (mV) ②	<20
	Voltage distortion ③	<0.3%@50Hz/60Hz
		<1%@0.001Hz-200Hz
	Load regulation	±0.05% F.S.
	Line regulation	±0.01% F.S. @10% variation
	Remote compensation	Adaptive
	Voltage slew rate	AC>3.0V/μs
Frequency	Resolution (Hz) ④	0.001
	Accuracy	±0.01%
Phase	Scope	A = 0°, B = 240°, C = 120° (default); programmable range: 0°~359.9°
	Accuracy ⑤	±0.1°@0.001-200Hz
	Resolution	±0.1°
Harmonics	Range	up to 100 times order @ 40-70Hz fundamental frequency;
		up to 25 times order @ 70-200Hz fundamental frequency;
	Content ⑥	40%
	Magnitude error	±5%@ set value or 0.1% of the fundamental frequency;
	Phase angle range	0°-359.9°

Specification

Indicators		Technical parameters
Current	Resolution (A)	0.01
	Peak factor ⑦	1~6
	Accuracy ⑧	±(0.1%+0.1% F.S.)@15~200Hz
DC Output		
Voltage	Resolution (V)	0.01
	Output accuracy ⑨	±(0.01%+0.05% F.S.)
	Output ripple (V_rms) ⑩	<0.35@(DC-300kHz)
	Load regulation	±0.05%F.S.
	Line regulation	±0.01%F.S.@10%变化
	Output slew rate	DC>3.0V/μs
Current	Resolution (A)	0.01
	Accuracy	±(0.1%+0.1% F.S.)
Transient		
Programming	Mode	List、Wave、Step、Pulse、Advanced、Harmonic, Interharmonic
	Minimum programming time step	100μs
	Number of programmed waveforms	100
	Synchronization source/ trigger source	Internal, external
	Data source	Edit, import, guide
	Analog programming	RMS, Amplitude, Instantaneous value(Amplifier mode)
Built-in standard	AC IEC61000	4-11、4-13、4-14、4-27、4-28、3-2、3-3、3-11、3-12
	DC IEC61000	4-17、4-29
Internal resistance mode	R range (Ω) ⑪	0~10
	L range (mH)	0~2
	Setting resolution	0.001
	Accuracy	0.1%+0.2% F.S.

Specification

Indicators		Technical parameters
RLC load		
Resistance	Range (Ω)	0.001~1000
	Resolution (Ω)	0.001
	Accuracy	±0.1% F.S.
Inductance	Range (mH)	0.1-5000
	Resolution (mH)	0.001
	Accuracy	±0.1% F.S.
Capacitance	Range (mF)	1~5000
	Resolution (mF)	0.1
	Accuracy	±0.1% F.S.
Crest factor	Range	1.000~5.000
	Resolution	0.001
Power factor	Range	-1.000~1.000
	Resolution	0.001
Measured Parameters		
AC voltage	Resolution (V_rms)	0.01
	Accuracy	0.01%+0.05% F.S.
Frequency	Resolution (Hz)	0.001
	Accuracy	±0.01%
AC current	Resolution	0.01
	Accuracy	0.1%+0.2% F.S.
Peak current	Resolution (A)	0.01
	Accuracy	±2% F.S.

Specification

Indicators		Technical parameters
Peak factor	Range	1.000~6.000
	Resolution	0.001
	Accuracy	±2% F.S.
Active power	Resolution (W)	1
	Accuracy ⑫	±0.2% F.S.
Apparent power	Resolution (VA)	1
	Accuracy ⑫	±0.1% F.S.
Power factor	Range	0.000~1.000
	Resolution	0.001
DC voltage	Resolution (V)	0.01
	Accuracy	0.1% F.S.
DC current	Resolution (A)	0.01
	Accuracy	±(0.1%+0.2% F.S.)
Input		
	Wiring method	Three-phase four-wire ABC+PE
	Frequency (Hz)	47-63
	Voltage range (V) ⑬	304~480
	Peak current (A)	< 1.5 * Rated Current
	Power factor	> 0.99
	Efficiency ⑭	> 0.91(Typical)

Specification

Indicators	Technical parameters
Interface	
Universal interface	Type-B USB、LAN
Environment	
Working range (°C)	0~50
Storage range (°C)	-20~70
Humidity	⩽80%
Size and Weight	
Dimension (W×H×D)	435mm×132mm×781mm
Weight	35kg

NOTE:

①: F.S. in the parameter table related to AC output voltage refers to the maximum AC voltage 450V;

②: DC component is set as output voltage 220VAC/ frequency 50Hz, tested under no load;

③: When the output frequency is ⩽200Hz, the maximum voltage distortion is tested under 250VAC and the pure resistive load to the rated output power;

④: The value will be chosen with the larger one in the situation when the resolution is 0.001 and 0.01% of the current setting value;

⑤: The phase precision is with 220V for the three-phase output voltage, phase is set to the default phase and the test is with no load;

⑥: 40% of the amplitude of 300V_rms refers to the total content of superimposed harmonics;

⑦: Peak factor (PF) refers to the ratio of peak current to RMS value. The typical value of standard sine wave is 1.414, and the maximum allowable value is 6. In addition, the peak value does not exceed the maximum current value of a single module, and does not refer to the peak factor under rated values;

⑧:F.S. in the parameter table related to AC current refers to the maximum current of the corresponding model;

⑨: Output impedance refers to the stable-state output impedance, and does not exceed the maximum output;

⑩: In the parameters table, the FS related to DC output voltage refers to the maximum DC voltage of 636V;

⑪: The output ripple voltage is 500V for the output DC voltage, and is with no load. The oscilloscope is AC coupled with 20MHz bandwidth limit;

⑫: The FS of active power and apparent power precision refers to the maximum measured power value of the machine of the corresponding model;

⑬: The input voltage 304-323V needs to be de-rated by 60%, and the input voltage 323-342V needs to be de-rated by 80%;

⑭: Power factor and efficiency index are tested under the three-phase input voltage of 380V, the set output of 220V, pure resistive load to the output power.

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