Power quality product introduction

Our power quality products, made of modern power electronic devices and high-speed DSP digital signal processing technology and FPGA miscellaneous programmable logic devices, are a new type of power quality management equipment, which can effectively improve system power quality indicators, increase power factor, eliminates harmonics, suppresses harmonics and resonance, improves three-phase imbalance, and ensures the long-term stable operation of the power system.



Core components

Comprehensive power electronics technology- IGBT power devices (the heart of PQ product)

IGBT is currently the fastest-growing fully-controlled power electronic device. It has the advantages of high input impedance, fast speed, high stability and high withstand voltage and withstand current ability. It is the core power component of power quality products.



Full control technology to achieve perfect power quality

Microprocessing and microelectronics technology- DSP+FPGA (the brain of PQ product). PQ product is based on three highspeed 32-bit DSP + FPGA digital signal processing technology with full digital control method, which is mainly used to realize the sampling, reading, transmission and calculation of tk parameters of complex algorithms; IGBT trigger signal generation; fault signal processing; communication and man-machine interface functions are the core calculation and control components of our power quality products, which can achieve the perfect power quality control effect with THDi \leq 5%, PF=1.00, and three-phase complete balance.

Static var generator (SVG/ASVG)

Product description

The SVG (static var generator) is mainly used for reactive power compensation, improving power factor, and optimizing power quality. Our SVG/ASVG covers 5kvar-100kvar specifications and models, with continuously adjustable compensation output, whichperfectly solves the shortcomings of the traditional stepped reactive power compensation mode.



Main application industry



Electricity



Communication



Electric vehicle charging station



Hospital



Airport



Solar energy generation



SVG/ASVG Working principle

SVG Working principle

SVG detects the load current in real time through an external CT, and analyzes the reactive content of the load current through the internal DSP calculation, and then controls the PWM signal generator according to the set value to send a control signal to the internal IGBT to make the inverter produce reactive power compensation current that meets the requirements, and finally realizes the purpose of dynamic reactive power compensation.

SVG Working principle



ASVG Work principle

The enhanced reactive power generator (ASVG)detects the load current in real time through an external CT, extracts the reactive components and harmonics of the load current after calculation by the internal DSP, and then sends PWM signal to the internal IGBT to control the inverter to generate required reactive current and low-order harmonic current, according to the setting and achieve the purpose of reactive power compensation and harmonic control;







SVG/ASVG/APF

SVG/ASVG Features

Fast response time

Full response time of SVG is less than 5ms, and the dynamic response time is less than 50 us, which is especially suitable for occasions where the load changes rapidly.

- Two-way compensation
- SVG can dynamically adjust the reactive power in both directions continuously(-1--1), and the continuous output reactive power factor can reach 0.99 from the rated inductive working condition to the rated capacitive working condition.



Small size, flexible combination, long life



SVG does not require large-capacity capacitors and reactors as energy storage components, and land occupation is usually only 50% or less of other types of dynamic compensation of the same capacity. At the same time, SVG adopts modular design and cabinet installation, and the engineering design and installation workload is small.

SVG adopts active compensation circuit, and the compensation capacity is little affected by the system voltage. When the system voltage becomes low, it can also output a reactive current, close to the rated condition.

Life 100000h

SVG itself has very low loss and basically does not require maintenance, and there is no problem of resonance over-voltage. The design life (MTBF is greater than 100,000 hours) is more than ten years.



In addition to the functions of SVG, the enhanced static var generator, ASVG, also supports low-order (3, 5, 7, 9, 11) small capacity (50% rated capacity) harmonic compensation.



Compensation capacity of SVG/ASVG is the installed capacity. SVG capacity can reach the same compensation effect, which can be 20%-30% smaller than the LC compensation capacity.



Catego	ry	Voltage	Capacity	Туре	Wiring
Common type	SVG	0.4kV	35/50/75/100kvar	rack / wall mounted	3P3W/3P4W
common type	ASVG	0.4kV	35/50/75/100kvar	rack / wall mounted	3P3W/3P4W
	SVG	6kV	1~21Mvar	indoor/outdoor	3P3W
HV type	SVG	10kV	1~42Mvar	indoor/outdoor	3P3W
	SVG	35kV	1~100Mvar	indoor/outdoor	3P3W

Note: SVG with different voltage levels can be customized.

Model Description



SVG/ASVG Parameters

1)	Capacity(KVar)	35	50	75	100
	Grid voltage	380V (-40% \sim +20%)	380V (-40% \sim +20%)	380V (-40% \sim +20%)	380V (-40% ~ +20%)
	Frequency	$45 { m Hz} \sim 62 { m Hz}$	$45 { m Hz} \sim 62 { m Hz}$	$45 { m Hz} \sim 62 { m Hz}$	$45 \mathrm{Hz} \sim 62 \mathrm{Hz}$
	Wiring	3P4L/3P3L	3P4L/3P3L	3P4L/3P3L	3P4L/3P3L
	Efficiency	≥ 97.5%	≥ 97.5%	≥ 97.5%	≥ 97.5%
Rated co	ompensation capacity	35kvar	50kvar	75kvar	100kvar
	Target power factor	-1 \sim +1 adjustable	-1 \sim +1 adjustable	-1 \sim +1 adjustable	-1 \sim +1 adjsutable
	Fast response time	<50us	<50us	<50us	<50us
	Full response time	<5ms	<5ms	<5ms	<5ms
	Filter function	ASVG has3、5、7、9、11 harmonic compensation function	ASVG has3、5、7、9、11 harmonic compensation function	ASVG has3、5、7、9、11 harmonic compensation function	ASVG has3、5、7、9、11 harmonic compenstion function
	Protective function	Grid over/lower voltage protection, short circuit protection, over compensation protection, IGBT over temperature protection, etc.	Grid over/lower voltage protection, short circuit protection, over compensation protection, IGBT over temperature protection, etc.	Grid over/lower voltage protection, short circuit protection, over compensatior protection, IGBT over temperature protection, etc.	Grid over/lower voltage protection, short circuit protection, over compensation protection, IGBT over temperature protection, etc.
Coi	mmunication Interface	RS485	RS485	RS485	RS485
	Protocol	Modbus	Modbus	Modbus	Modbus
	User Interface	HMI 4.3 inch	HMI 4.3 inch	HMI 4.3 inch	HMI 4.3 inch
	Installation method	rack/wall mounted	rack/wall mounted	rack/wall mounted	rack/wall mounted
	Dimensions	556. 5*359*200 (rack)	611. 5*399*200 (rack)	646*484*232 (rack)	656*554*250 (rack)
	Weight	22kg	28 kg	38kg	46 kg
	Cooling	Smart air cooling	Smart air cooling	Smart air cooling	Smart air cooling
	Ambient temperature	-25 ∼ +45°C	-25 ∼ +45°C	-2s~+4s ⁰ c	-25 ~ +45°C

SVG/ASVG capacity calculation

The capacity S of ASVG is determined by the reactive power capacity Q1 and the harmonic capacity Qh required by the system.

$$S = \sqrt{Q_1^2 + Q_h^2}$$
 (and $S \ge 2Q_h$) (formula 5)

In the case of less harmonic content, the reactive power capacity can be approximated by an appropriate margin to obtain the ASVG capacity. If the harmonic content is large, it must be calculated by formula 5.shown above.

Reactive power compensation capacity calculation

The reactive power compensation capacity is usually selected according to 30% of the system capacity. For specific calculations, please refer to the following table:

	CosQ, (after compensation)												
Cos1 (before)	0.80	0.85	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	Unity
0.50	0.982	1.112	1.248	1.276	1.306	1.337	1.369	1.403	1.440	1.481	1.529	1.590	1.732
0.51	0.937	1.067	1.202	1.231	1.261	1.291	1.324	1.358	1.395	1.436	1.484	1.544	1.687
0.52	0.893	1.023	1.158	1.187	1.217	1.247	1.280	1.314	1.351	1.392	1.440	1.500	1.643
0.53	0.850	0.980	1.116	1.144	1.174	1.205	1.237	1.271	1.308	1.349	1.397	1.458	1.600
0.54	0.809	0.939	1.074	1.103	1.133	1.163	1.196	1.230	1.267	1.308	1.356	1.416	1.559
0.55	0.768	0.899	1.034	1.063	1.092	1.123	1.156	1.190	1.227	1.268	1.315	1.376	1.518
0.56	0.729	0.860	0.995	1.024	1.053	1.084	1.116	1.151	1.118	1.229	1.276	1.337	1.479
0.57	0.691	0.822	0.957	0.986	1.015	1.046	1.079	1.113	1.150	1.191	1.238	1.299	1.441
0.58	0.655	0.785	0.920	0.949	0.979	1.009	1.042	1.076	1.113	1.154	1.201	1.262	1.405
0.59	0.618	0.749	0.884	0.913	0.942	0.973	1.006	1.040	1.077	1.118	1.165	1.226	1.368
0.60	0.583	0.714	0.849	0.878	0.907	0.938	0.970	1.005	1.042	1.083	1.130	1.191	1.333
0.61	0.549	0.679	0.815	0.843	0.873	0.904	0.936	0.970	1.007	1.048	1.096	1.157	1.299
0.62	0.515	0.646	0.781	0.810	0.839	0.870	0.903	0.937	0.974	1.015	1.062	1.123	1.265
0.63	0.483	0.613	0.748	0.777	0.807	0.837	0.870	0.904	0.941	0.982	1.030	1.090	1.233
0.64	0.451	0.581	0.716	0.745	0.775	0.805	0.838	0.872	0.909	0.950	0.998	1.058	1.201
0.65	0.419	0.549	0.685	0.714	0.743	0.774	0.806	0.840	0.877	0.919	0.966	1.027	1.169
0.66	0.388	0.519	0.654	0.683	0.712	0.743	0.775	0.810	0.847	0.888	0.935	0.996	1.138
0.67	0.358	0.488	0.624	0.652	0.682	0.713	0.745	0.779	0.816	0.857	0.905	0.099	1.108
0.68	0.328	0.459	0.594	0.623	0.652	0.683	0.715	0.750	0.787	0.828	0.875	0.936	1.078
0.69	0.299	0.429	0.565	0.593	0.623	0.654	0.686	0.720	0.757	0.798	0.846	0.907	1.049
0.70	0.270	0.400	0.536	0.565	0.594	0.625	0.657	0.692	0.729	0.770	0.817	0.878	1.020
0.71	0.242	0.372	0.508	0.536	0.566	0.597	0.629	0.663	0.700	0.741	0.798	0.849	0.992
0.72	0.214	0.344	0.480	0.508	0.538	0.569	0.601	0.635	0.672	0.713	0.761	0.821	0.964
0.73	0.186	0.316	0.452	0.481	0.510	0.541	0.573	0.608	0.645	0/686	0.733	0.794	0.936
0.74	0.159	0.289	0.425	0.453	0.483	0.514	0.546	0.580	0.617	0.658	0.706	0.766	0.909
0.75	0.132	0.262	0.398	0.426	0.562	0.487	0.519	0.553	0.590	0.631	0.679	0.739	0.882
0.76	0.105	0.235	0.371	0.400	0.429	0.460	0.492	0.526	0.563	0.605	0.652	0.713	0.855
0.77	0.079	0.209	0.344	0.373	0.403	0.433	0.466	0.500	0.537	0.578	0.626	0.686	0.829
0.78	0.052	0.183	0.318	0.347	0.376	0.407	0.439	0.474	0.511	0.552	0.599	0.660	0.802
0.79	0.026	0.156	0.292	0.320	0.350	0.381	0.413	0.447	0.484	0.525	0.573	0.634	0.776



Product Size







Size		V	/all mounted							
(mm)	20kvar 35kvar	50kvar	75kvar	100kvar						
A	521.5	545	611	621						
В	500	520	575	585						
С	300	360	300	300						
D	120.5	85.5	137.5	142.5						
E	379	419	500	570						
F	350	390	475	545						
G	315	355	440	510						
Н	200	200	232	250						
4-012*18 Mounting holes										

Size of wall mounted type Note: The size is for reference only, and the actual product shall prevail. For other sizes, please refer to the product manual.

SVGC product description



SVGC compensation system combines the advantages of both dynamic compensation SVG and static compensation capacitors. The relatively stable reactive power demand part of system can be statically compensated by the capacitor; for the fast-changing reactive power demand part of the system, the SVG can be used for quick compensation. The system can not only meet the user's reactive power compensation needs, but also greatly reduce equipment costs.

SVGC Features



Fast response time Full response time< 1 Oms;



Economical

Give full play to the advantages of the two, high cost performance, large compensation capacity, and extend the service life:



Wide range of applications It can be used in a variety of sites, and it can

also meet the places with high harmonics and high compensation requirements;



Flexible application

Cooperate with smart capacitors or contactors, thyristors, load switches, etc. for common compensation

SVGC working principle

- 1. SVG checks the reactive power value of the system through an external transformer;
- 2. When inductive reactive power is detected in the system, SVG works in milliseconds to quickly improve the power factor;
- 3. The control capacitor is gradually put into operation, and the SVG investment is gradually reduced. Until the power factor on the system side reaches the standard, the entire compensation process becomes stable.
- 4. SVG priority control capacitor input compensation:

If the capacity or response speed is not enough, SVG will be used for compensation;

When inductive reactive power is detected in the system, SVG is directly used for compensation.



SVG/ASVG/ APF

SVGC Control logic

Large screen controller:

7 inch or 10 inch touch color man-machine interface are equipped;

Set the working mode and related parameters of SVG and capacitor;

Real-time display of power parameters such as power, data before and after compensation, waveform graph, histogram, monitoring and control of the working status of SVGC; with 8/16 channels and 10 ports, which can be expanded to 32 channels;

Supports more than 15 combined compensation modes.

SVG module:

With RS232/RS485 communication interface and standard RS485, CAN bus communication protocol;

Quickly compensate system reactive power changes, and compensate the reactive power of the system (over or under compensation) to 0.99; Support the switching control of any type of smart capacitor from various manufacturers (communication protocol is required);

The standard type realizes automatic and manual switching control of up to 24 smart capacitors (16 channels total and 8 channels separate compensation), and can be customized to control more than 24 channels.

Capacitor

According to the reactive power demand of the system, the required capacitor bank can be put into operation in one step to shorten the switching time; quickly compensate the reactive power change of the system, and compensate the reactive power part of the system (over or under compensation) to zero;

Realize step-less switching, realize fast and accurate compensation of reactive power changes;

Compensate most of the load's stable, less-changing reactive power;

With anti-harmonic function, it is suitable for places with large harmonics.

SVGC Working diagram



Note: When using more than 2 SVG modules, current sampling must be on the load side!



Note: When using more than 2 SVG modules, current sampling must be on the load side!

SVG+Traditional LC schematic

- 1) The module has its own output DC12V, DC24V, which could provide power when the thyristor or composite switch is used as a switching switch;
- 2) When the contactor switches the capacitor, it is needed to connect 220V power supply from outside.





Maximum capacity and number of SVGC in standard electrical cabinet

SVGC is suitable for installing and using in standard electrical cabinets (GGD, GCK, GCS, MNS, etc.). SVGCs can be installed in two layers, up and down, in standard electrical cabinet with a height of 2200mm. The upper part is installed with rack-mounted SVG modules and the lower part is installed with capacitors. It can also be installed back and forth when the depth of the cabinet allows. Either capacitor or traditional LC can be installed in back and forth part; the configuration capacity and number of units are shown in the table below:

SVG+Common smart capacitor

	SVG+Common smart capacitor										
Cabinet d	lepth(mm)		600 800					1000			
Cabinet v	vidth(mm)	600	800	1000	600	800	00 1000 600 800				
Maximum	Total capacity	195	300	380	300	340	420	340	420	580	
(kvar)	Capacitor capacity	160	200	280	200	240	320	240	320	480	
	SVG capacity	35	100	100	100	100	100	100	100	100	
	Total number	5	6	8	6	7	9	7	9	13	
Maximum number of	Number of capacitors	4	5	7	5	6	8	6	8	12	
units	SVG number	1	1	1	1	1	1	1	1	1	

Note: The number of installed svgs above is for reference only, and is subject to actual production.

SVG+Anti-harmonic smart capacitor

	SVG+Anti-harmonic smart capacitor											
Cabinet	depth(mm)		600			800			1000			
Cabinet	width(mm)	600	800	0 1000 600 800 1000 600 800					800	1000		
Maximum	Total capacity	115	220	260	220	260	300	260	340	420		
(kvar)	Capacitor capacity	80	120	160	120	160	200	160	240	320		
	SVG Capacity	35	100	100	100	100	100	100	100	100		
	Total number	3	4	5	4	5	6	5	7	9		
Maximum number	Number of capacitors	2	3	4	3	4	5	4	6	8		
of units	SVG number	1	1	1	1	1	1	1	1	1		

SVG+C Traditional parts

	SVG+C Traditional parts											
Depth of ca	abinet (mm)			600		800			1000			
Width of ca	abinet (mm)	600	800 1000 600 800 100				1000	600	800	1000		
	Total capacity	195	300	380	220	300	380	220	300	380		
Max. capacity	Capacitor capacity	120	200	280	120	200	280	120	200	280		
(kvar)	SVG capacity	35	100	100	100	100	100	100	100	100		
Max no.	Total no.	3	4	8	4	6	8	4	6	8		
	Capacitor no.	2	3	7	3	5	7	3	5	7		
	SVG no.	1	1	1	1	1	1	1	1	1		

	SVG+LC Traditional parts											
Depth of	cabinet(mm)	et(mm) 600 800 1000				1000						
Width of o	cabinet(mm)	600	800	1000	600	800	1000	600	800	1000		
	Total capacity	115	220	260	180	220	260	220	300	340		
Max capacity (kvar)	capacitor capacity	80	120	160	80	120	160	120	200	240		
	SVG capacity	35	100	100	100	100	100	100	100	100		
	Total no,	3	4	5	3	4	5	4	6	7		
Max no.	capacitor bank	2	3	4	2	3	4	3	5	6		
	SVG no.	1	1	1	1	1	1	1	1	1		

Note: If you need other SVGC solutions, please contact our company!

Note: The number of installed devices above is for reference only, and is subject to actual production.



SVGC capacity configuration

Transformer capacity	Reactive	SVGC Solu	ution ONE	SVGC S	Solution Two
(KVA)	(Kvar)	SVG	Traditional capaci	or SVG	Smart capacitor
125	40	15	25	15	25
160	50	15	15 35		35
200	60	35	25	35	25
250	75	35	40	35	40
315	100	35	65	35	65
400	120	35	85	35	85
500	150	50	100	50	100
630	200	50	150	50	150
800	250	50	200	50	200
1000	300	100	200	100	200
1250	400	100	300	100	300
1600	500	200	300	200	300
2000	600	200	400	200	400
2500	750	200	550	200	550
3150	950	300	650	300	650
*0 6		- 6 414			

*Configured according to 30% of the system capacity.

SVGC Applications



Active power filter (APF)

Product description

The CF series active filter is a three-level high-power density power electronic product applied to suppress power harmonics and dynamic reactive power compensation. The products include 5OA, 75A, 100A, 150A specifications. The main function is harmonic compensation, which can be widely used to improve the power quality of the 0.4KV power supply system.





Main application industry



Petrochemical



Steel



Rail



Solar energy generation



Communication



Hospital

APF Working principle

APF detects the load current in real time through the external CT, calculates and extract the harmonic components of the load current through the internal DSP. Then signal from PWM is sent to the internal IGBT, and the inverter is controlled to generate a current with the same magnitude and opposite direction as the load harmonic and inject it into the grid to compensate the harmonic current to achieve the filtering function.



The superposition of each harmonic current and the fundamental current finally shows a non-sinusoidal waveform.



Features

■ High efficiency: accurate algorithm to reduce IGBT loss, optimized magnetic component design, efficiency≥97.5%



- Three-level technology, modular design, high power density, rack-mounted installation, easy maintenance
- Excellent air duct design, higher heat dissipation efficiency, longer device life





Double DSP + FPGA architecture, triple protection logic, high system reliability



 Unique positive sequence phase lock control and intelligent FFT, perfect compensation



Support multi-machine parallel connection, arbitrary capacity combination parallel, independent cabinet, maximum support 600A, flexibly meet the user's on-site needs







Category	Voltage	Capacity	Model	Wiring
APF	400V	50A/75A/100A/150A	Rack/wall mounted	3P3W/3P4W
APF	690V	50A/100A	Rack/wall mounted	3P3W/3P4W

Model Description



Product parameter

Capacity(A)	50	75/100	150						
Grid voltage	380V (-40% \sim +20%)	380V (-40% \sim +20%)	380V (-40% \sim +20%)						
Grid frequency	$45 { m Hz} \sim 62 { m Hz}$	$45 \text{Hz} \sim 62 \text{Hz}$	$45 { m Hz} \sim 62 { m Hz}$						
Grid system	3P4W/3P3W	3P4W/3P3W	3P4W/3P3W						
Efficient	≥97%	≥97%	≥97%						
Parallel	<8 sets	<8 sets	<8 sets						
Rated compensation current	50A	50A/75A	150A						
Filter range	2 \sim 50th adjus table	2~50th adjustable	2~50th adjustable						
Filtering ability	THDi< 5%	THDi< 5%	THDi< 5%						
Fast response time	<50us	<50us	<50us						
Full response time	<15ms	<15ms	<1 Sms						
Compensation function	Support harmonic compensation, unbalance compensation, reactive power compensation	Support harmonic compensation, unbalance compensation, reactive power compensation	Support harmonic compensation, unbalance compensation, reactive power compensation						
Protective function	Grid over voltage protection, short circuit protection, over compensation protection, IGBT over temperature protection, etc.	Grid over voltage protection, short circuit protection, over compensation protection, IGBT over temperature protection, etc.	Grid over voltage protection, short circuit protection, over compensation protection, IGBT over temperature protection, etc.						
Communication Interface	RS485	RS485	RS485						
Protocol	Modbus	Modbus	Modbus						
User Interface	HMI (4.3 inch)	HMI (4.3 inch)	HMI (4.3 inch)						
Installation method	rack/wall mounted	rack/wall mounted	rack/wall m ounted						
Size	556.5*359*200 (rack)	611 5*399*200 (rack 646*484*232 (rack)	656*554*250 (rack)						
Weight	22 kg	28 kg /38 kg	46 kg						
Cooling method	Smart air cooling	Smart air cooling	Smart air cooling						
Altitude	< 1500m; between 1500-4000m, accorreduced by 1%	ording to the GB/T3859.2, for every	additional 100m, the power is						
Operating temperature		-25°C~+45°C							
Relative humidity		5%-95%, no condensation							
Protection level	IP20 , oth	IP20 , other IP grades can be customized							

SVG/ASVG/APF

APF Selection

Local treatment checklist

		APF Configuration capacity (A)											
Equipment capacity (power) (kW)	Lighting source	Office light source	UPS (6pulse	Switch ing power supply	frequency converter	DC drive	SCR dimming	Gem heating furnace	Medical device	Charger	Central air conditi oning	elevator	Intermediate Frequency Furnace Electric Arc Furnace
THDi	15%	15%	35%	40%	40%	45%	30%	30%	30%	55%	15%	40%	40%
10	25	25	25	25	25	25	25	25	25	25	25	25	25
20	25	25	25	25	25	25	25	25	25	25	25	25	25
30	25	25	25	25	25	25	25	25	25	35	25	25	25
50	25	25	35	50	50	50	35	35	35	50	25	50	50
75	25	25	50	60	60	75	50	50	50	75	25	60	60
100	35	35	75	75	75	100	60	60	60	100	35	75	75
125	50	50	100	100	100	100	75	75	75	125	50	100	100
150	50	50	100	125	125	125	100	100	100	150	50	125	125
175	60	50	125	150	150	150	125	100	100	175	60	150	150
200	60	60	150	150	150	160	125	125	125	200	60	150	150
250	100	100	200	200	200	200	150	150	150	250	100	200	200
300	100	100	200	225	225	250	175	175	175	300	100	225	225
400	125	125	250	300	300	350	250	250	250	400	125	300	300
500	150	150	350	400	400	400	300	300	300	500	150	400	400

1. The above table assumes that the natural power factor of equipment is 0.9 and the harmonic current is calculated under full-load working condition. 2 The third row of the above table indicates the current total harmonic distortion rate THDi recommended for the load.

3. The capacity of some equipments are not listed in the above table, but the corresponding harmonic current value can be calculated according to the ratio of capacity. For example, the harmonic current value of 100kW equipment is twice that of 50kW.

Centralized treatment checklist

		APF Configuration capacity (A)								
Transformer capacity/kVA	Building/Subway	Medical/Tire/Metallurgy	Manufacturing /new energy/automobile	Arts Center/Silicon Manufacturing/ Petroleum Exploration	Chemical industry					
THDi	10%	15%	20%	25%	30%					
200	35	50	50	60	100					
250	35	50	75	75	100					
315	50	60	100	100	125					
400	400 50 500 60		100	125	150					
500			125	150	180					
630	100	125	160	200	250					
800	100	150	200	250	300					
1000	125	200	250	300	350					
1250	160	250	300	400	450					
1600	1600 200		400	500	550					
2000	250	360	500	600	700					
2500	300	450	600	700	800					

The above calculation is based on the K value of 0.8, where the K value is the load factor of the transformer. Different load rates can be calculated proportionally.

Harmonic capacity calculation

Centralized treatment

$$I_h = \frac{S \times K}{\sqrt{3} \times U \times \sqrt{1 + T H D t^2}} \times T H D i$$
 (公式1) formula 1

Note: The above formula is suitable for centralized management on the secondary side of the transformer. Introduction to formula parameters:

S: Transformer rated capacity; U: Transformer secondary side rated voltage; I: Harmonic current;

THDi: Current total harmonic distortion rate; K: Load factor; represents the load factor of the transformer, the value range of the transformer design is 0.6--0.85.

THDi is the only variable in the above formula, and its value range depends on different industries and different loads.

Local treatment

The above formula is based on centralized treatment of harmonics on the secondary side of transformer. Here, it is recommended that designers perform treatment on the secondary side of transformer. If there is a higher-power harmonic source load in the power distribution, it can also be treated locally at the input of the load. The following formula 2 can be used to calculate.

$$I_h = I_N \times \frac{THDi}{\sqrt{1 + THDi^2}}$$
(公式2) formula 2 $I_h = K \times I_N \times \frac{THDi}{\sqrt{1 + THDi^2}}$ (公式3) formula 3

Among them, In represents the rated current of the device. The above formula only considers that the load is running at full load condition (K=N1). The actual operating value of K should be considered in the design, as shown in formula 3.

Estimation formula In daily design, we can use estimation formula 4:

 I_h = Calculate current x THDi(formular 4)

Note: According to the above analysis: THDi is the main variable that needs to be determined. For the selection of this value, please refer to APF Selection treatment checklist;.

Installation parameters

Rack-mounted AP	Installation parameters	j			
Capacity(A)	Size (mm)	Weight (Kg)	Fixing mode	Cooling	Wiring
50	556.5*359*200	22 _{Fro}	nt panel mounting ears A	r cooling, front in, back out	Back inlet
75	61,1 5*399*200	28 Fr	ont panel mounting ears Ai	cooling, front in, back out	Back inlet
100	646*484*232	38 Fro	nt panel mounting ears air	cooling, froņt in, back out	Back inlet
150	656*554*250	46 Fro	nt panel mounting ears _{Air}	cooling, front in, back out	Back inlet

Wall mounted APF installation parameters

С	apacity(A)	Size(mm)	Weight (Kg)		Fixing mode		Cooling	Wiring
	50	521.5*379*200	22	Lef	t and right ears	air	cooling, down in up out	upper inlet
	75	545*419*200	28	Le	t and right ears	air	cooling, down in up out	upper inlet
	100	611*500*232	38	Lef	and right ears	air d	cooling, down in up out	upper inlet
	150	621*570*250	46	Left	and right ears	air	cooling, down in up out	upper inlet



APF Size





ai=a		Rack type								
(mm)	30A 50A	75A	100A	150A						
Α	359	399	484	554						
В	341	381	466	536						
С	315	355	440	510						
D	200	200	232	250						
Е	89	89	89	89						
F	55.5	55.5	71.5	80.5						
G	556.5	611.5	646	656						
Н	500	555	575	585						
K	35	35	35	35						

Rack size



Note: The size is for reference only, and the actual product shall prevail. For other sizes, please refer to the product manual.

Industrial compensation module

Status of industrial enterprises

With the continuous improvement of the industrialization level, the electrification level of industrial enterprises has also increased, and the load with nonlinearity has also increased. For example, the motors and transmission devices in modern industrial enterprises almost all use thyristors and other converter equipment. In addition, electric arc furnaces, Frequency conversion devices, fluorescent lamps, and computers are being promoted. The harmonics generated in industrial enterprises are mainly generated during the operation of these transmission and distribution equipment and electrical equipment with nonlinear volt-ampere characteristics. It is the harmonics generated by this non-linear relationship that reduce the quality of power, affect the safe and economic operation of enterprise electrical equipment, and increase the interference to communications and other systems. Therefore, we regard harmonics "pollution" and "public hazards" to the power system. Harmonic pollution to the electromagnetic environment of the power system will endanger the power system itself and the majority of power customers, and the harm is very extensive. Therefore, it is necessary to improve the quality of power supply and ensure the safe and economic operation of the power system from the perspective of reducing its hazards to various electrical equipment and the environment, and to control and eliminate harmonic currents in industrial enterprises.



Common equipment that pollute the power grid

Name	Field
Frequency converter	Textile mills, rolling mills,
DC governor	Steel rolling mill,
ing power supply equipment	Locomotive traction
nduction heating equipment	New material preparation,
temperature control heating	smelting Glass, chemical industry
ding equipment Electric arc	Automobile manufacturing, machinin
furnace equipment	Smelt
	Name Frequency converter DC governor ing power supply equipment aduction heating equipment temperature control heating ding equipment Electric arc furnace equipment

Ferromagnetic saturation type: transformers, reactors, transformers, etc. For these power equipment with iron cores, the iron core saturation current, excitation current, and excitation inrush current during input or voltage recovery are all non-sine waves and contain high-order harmonics.

Electronic switch type: rectifier, inverter, frequency converter and thyristor switch equipment, etc. The characteristics are mainly related to the number of pulsations of the rectifier. The 6pulsation rectifier produces 6k soil first harmonic, and the 12pulsation produces 12k soil first harmonic.

Arc type: steelmaking furnace, metal melting equipment, electric welding machine group, etc. It directly affects the grid voltage, which may cause voltage flicker, and the production equipment cannot work normally, often fails, and it changes with the working status of the equipment.

1. Device integration, on-board design, small module size, powerful function, and beautiful appearance.

- 2. Small-capacity power devices have high switching frequency and three-level topology.
- 3. High power density, low cost, standardized products, mass production.

🕒 Industrial modular design concept

The design concept of conventional modules

1. Adopting a two-level design concept, the power device has larger capacity selectivity; the peak factor is generally selected to be 3 times, even 4 times in special conditions, and the equipment can be operated at full load.

2. Normal operation under high voltage distortion rate. 3. Care more about dustproof and heat dissipation.

4. Impact resistance, strong anti-interference, and full load output.
5. Voltage sampling isolation, improved phase lock algorithm, can accurately lock the voltage zero crossing point.
6. LCL adopts large-capacity damping resistors and capacitors. The damping resistor can reach 600W in a single phase, with larger absorption margin.
7. The module adopts a vertical structure design and chooses a centrifugal large-capacity fan. Except for the radiator and inductor, the rest are not in the air duct. The bottom of the module enters air, and the top of the module exits.

8. The front and rear door panels of the whole cabinet have air inlets at the lower part, and dust-proof shutters are added. The top is exhausted by a centrifugal large-capacity fan, which has good insulation and heat dissipation and good dust-proof effect. 9. The module is large in size and can be placed with a large-capacity inductor, which can operate stably under large impacts. 10. With 3P3W design and DQ instantaneous reactive power extraction algorithm, under the same conditions, the equipment responds faster.



Features

Industrial vertical structure

The vertical structure is a product specially developed by our company for the industrial application environment. It has a unique structural design. The single module adopts an axial fan for heat dissipation. The air volume is large, the air pressure is sufficient, and the heat dissipation performance is good. The top of the whole cabinet is drawn by an axial fan, and the bottom is drawn with dust-proof louvers, which can isolate the external environment to a greater extent. Currently, it is mainly used in environments such as non-linear loads, large AC and DC motors, rectifier equipment, and rapidly changing loads. Such as: rolling mill, electric arc furnace, intermediate frequency furnace, mine hoist, electric locomotive power supply system.



Core parts selection

The core power device IGBT is imported from Germany, and the power devices have enough safety margin. The professional IBGT selected for industry is more than 3 times the rated effective value, which guarantees the reliability and stability of the product to the greatest extent. Under the big impact, it can work for a long time.





Industrial 100Kvar module uses 450A Adaptable high-power IGBT

Inductance parts for industrial 100Kva module (Independent air duct, good heat dissipation, no on-board solder joints, favorable insulation)

The working voltage ranges from 210V to 750V, and the installation and design methods are flexible. It is suitable for the power supply of diesel engine and area with large deviation of voltage amplitude rate, high temperature, low temperature, high humidity, salt spray, corrosion and other sites. It is especially suitable for 40-55°C high temperature industrial sites and harsh environments, especially dusty applications. For example: Powder Factory, Powder Stone Factory, Brick Factory, Cement Factory, etc.

Anti-high voltage distortion

It is suitable for industrial load distribution system, with 5%-25% harmonic voltage distortion rate. The instantaneous response speed is microsecond level, and the total response time is less than 10ms.

Full compensation, safety and stability

Inductive and capacitive reactive power compensation, unbalance compensation, neutral compensation; lots of choices for selection. Three-level design, the smallest switching ripple in the industry; automatic current-limiting operation and comprehensive fault protection functions.

Advanced control strategy and topology design

Using LCL topology filter, in the case of outputting harmonic current, it will not introduce high-frequency IGBT switching harmonic interference, and it is suitable for any on-site grid system impedance, without resonance.

Fault self-diagnosis and self-start function

The device has the function of self-recovery from shutdown caused by non-device's own problems. Before self-recovery, the external power grid and the device itself will be automatically diagnosed, and the diagnosis can be self-started. If there is a problem with the external power grid, the equipment will no longer start, and an alarm will be given to the upper computer t and the failure indicator will be lit.

Remote IoT monitoring function

It can collect three-phase system voltage, current, active power, reactive power, power factor, harmonic content, device output harmonic current and other data, and upload it to the database through the GPRS module. It supports mobile APP downloading, and web browsing, real-time monitoring, historical data download and equipment startup/shutdown operations

• Technical parameter

	System voltage(V)	400~750V AC	
	System voltage range	±10%	
	Frequency(Hz)	50/60 +/-5%	
	Compensation rate	≥95%	
	Full response time	≤10ms	
Electrical	Transient response time	≤100us	
Electrical	Working way	Active power compensation, unbalance compensation	
periormance	Power factor correction	yes, adjustable	
	Overload protection	Automatic current limit at 100% rated output	
	Other protection	Overvoltage protection, overcurrent protection, undervoltage protection, overtempera	ature protection
	Single unit operation	Yes	
	Parallel operation	Yes	
	Switching frequency	10~20KHz	
	U	7 inch touch screen	
	Display state	Current, voltage, power, harmonic distortion rate, etc.	
Control	Operate	Multiple operation mode for options, remote or local	
cnaracteristics	Communication (RS485	Modbus-RTU has a remote monitoring interface and a background database, which is conv	venient
	interface)	for users to monitor equipment operation parameters on the Internet terminal	
	IoT cloud platform service	IoT controller and IoT cloud platform service are optional	
	Weight	Please refer to the selection table	
	Installation method	Indoor or outdoor installation	
Structural	Protection level	IP21 or customized according to user requirements	
characteristic	Noise	≤55dB@1m	
	Cooling method	Forced air cooling	
	Working ambient temperatur	_e - 25℃~50℃	
Environmontal	Storage/transportation	- 40°C~70°C	
requirements	Working/storage relative humidity	Relative humidity 20%~95%, non-condensing / Relative humidity 10%~95%, non-co	ondensing
	Altitude	≤1000m rated capacity;>1000m, reduce capacity properly.	

Specification and model

Categor	y	Specifications	Model
Industrial APF		150A	CF-APF(InD)-0.4/150-4L
APF	APF	200A	CF-APF(InD)-0.4/200-4L
Industrial	SVG	100kvar	CF-SVG(InD)-0.4/100-4L
SVG	SVG	150kvar	CF-SVG(InD)-0.4/150-4L

SVG/ ASVG/ APF

Product Size



Maximum configuration capacity and number of units in a standard electrical cabinet

Cabinet depth (mm)		800			1000	
Cabinet width (mm)	600	800	1000	600	800	1000
Maximum current (A)	400	400	600	400	400	600
Maximum capacity (kvar)	300	300	450	300	300	450
Max. no	2	2	3	2	2	3

Note: The number of installed machines above is for reference only, and is subject to actual production.

Plug-in compensation module



The plug-in active compensation module is independently developed and designed by our company. This ultra-thin, ultra-light and ultra-quiet compensation device has a thickness of only 88mm, a weight of about 10 kg, a module capacity of 20A~50A. Its application fields include precision production, commercial shopping malls, data processing, industrial manufacturing and many other fields.

Features



Module cooling fan has low power, excellent air duct, low loss and low noise



Multi-combination, multi-mode, can control harmonics, reactive power, and control capacitor switching



Module has ultra-thin body, whose thickness is 88mm; multiple modules can be stacked horizontally and vertically



Built-in various sensors, overvoltage, over-current protection, etc., to ensure the safety of electricity use



It is equipped with hot-swappable terminals, which makes it is easy to maintain and replace.



Support device data to the cloud, which can be viewed in real time on mobile phones and PCs

Product specification and model

Product type	Specifications	Model
APF	35A	CF-APF (Tud) -0.4/35A-4L
Pluggable	43A	CF-APF (Tud) -0.4/43A-4L
SVG	25kVar	CF-SVG (Tud) -0.4/25kVar-4L
Pluggable	30kVar	CF-SVG (Tud) -0.4/30kVar-4L

SVG/ASVG/ APF



Product size



Schematic diagram of cabinet assembly



Maximum configuration capacity and number of units in a standard electrical cabinet

Cabinet depth(mm)	600			800			1000		
Cabinet width(mm)	600	800	1000	600	800	1000	600	800	1000
Maximum current(A)	258	344	430	258	344	430	258	344	430
Maximum capacity(kvar)	180	240	300	180	240	300	180	240	300
Maximum number of units	6	8	10	6	8	10	6	8	10

Note: The number of installed devices above is for reference only, and is subject to actual production.

Power quality management strategy



Power quality problem management strategy

Local management

When the harmonic pollution source of the power grid is highly concentrated on one or several terminal loads, the local treatment method is applicable.



Partial managment

When the harmonic pollution source of the power grid is highly concentrated on one or several branches, some treatment methods are applicable.



Overall management

When the harmonic pollution sources of the power grid are scattered in the entire distribution system, the overall management method is applicable.



Power quality management case

Case NO.1

Inverter-the contradiction between energy saving and power quality

Harmonic characteristics

The frequency of harmonics of the inverter is mainly the 5th, 7th, and 11th harmonics, and the current distortion rate is about 40% under the rated working conditions (there is a slight difference due to the difference in topology). The current distortion rate is higher at light load, and can even reach more than 100%.

Common application industries

Petrochemical and mining and metallurgy, chemical industry, modern architecture, school, large playground, port terminal, airport, automobile factory and other equipment manufacturing, thermal power and new energy, etc.

Typical inverter management case: a petrochemical project in Zhejiang in China

背景

The use of high-power frequency converters in petrochemical power distribution systems generates a large number of harmonics, causing the total voltage distortion rate to exceed 5% of the national standard, and the total current harmonic distortion rate reaches about 22%, and the loss of cables and transformers increases.

治理 方案

Install active power filter at the inlet of the frequency converter for on-site management.

Data comparison before and after management

1	Measurement items		Phase A		Phase B		Phase C	
		National standard	before	after	before	after	before	after
Total voltage distortion rate THDu		<5%	6.6%	2.8%	7.2%	3.3%	6.9%	2.7%
Current harmonic total distortion rate THDi		《GB/T 14549-93 》	19.1%	3.8%	21.6%	4.6%	20.5%	3.9%
	5th harmonic current(A)	310	361.7	47.3	393.6	39.3	400.8	52.7
	7th harmonic current(A)	220	138.8	9.1	167.3	20.4	125.8	10.9



SVG/ASVG/ APF

Case No. 2

UPS-a powerful tool for continuous power supply and voltage quality, but it needs to improve current quality.

Harmonic characteristics

The UPS with 6-pulse rectification, three-in and three-out, mainly contains the 5th and 7th harmonic components, and the current distortion rate is 35%-40%. The 12-pulse rectifier UPS is mainly the 11th and 13th harmonics. The current distortion rate of the 12-pulse rectifier UPS is relatively low, usually between 8%-20%.

Common application industries

Banks, rail transit, hospitals and airports, IDC computer rooms for communications, finance, insurance, and various other occasions that are sensitive to electricity requirements.

Typical UPS management case: a railway station



The power and information system of the railway station uses a three-phase 6-pulse rectifier UPS, which produces a total current harmonic distortion rate of about 25%, which far exceeds the standard of 3%-5% harmonic rate. The use of active filter devices can reduce the current The harmonic distortion rate drops to less than 5%.

治理 方案

Install 8 active power filters at the incoming line of UPS for harmonic control.

			phase A		ph	ase B	phase C	
	Measurement items	National standard	before	after	before	after	before	after
Total	voltage distortion rate THDu	<5%	5.36%	1.51%	4.93%	1.44%	5.37%	1.49%
	PF		0.93	0.98	0.94	0.98	0.91	0.97
5th	harmonic current (A)	25.4	55.52	4.11	53.72	5.30	58.14	6.02
7th	harmonic current (A)	21.6	31.96	6.25	34.02	6.20	34.22	5.89
11th	harmonic current (A)	17.9	19.45	3.18	17.89	3.18	19.30	4.03

Data comparison before and after management



Case No.3

Single (multiple) crystal furnace-the significance of power quality to high-value production processes

Harmonic characteristics

The main harmonics produced by the sapphire furnace in the system are 5th, 7th, 11th, 13th, 17th, 19th, and the current distortion rate is as high as 40%-76%;

Common application industries

Solar panel factory, sapphire industry, etc.

A typical single (multi) crystal furnace management case: a photoelectric Co., Ltd.

A optoelectronics Co., Ltd. is mainly engaged in the R&D and sales of LED sapphire substrates. The main production equipment is a single polycrystalline furnace, which generates a large number of harmonics during operation. The entire production cycle is as long as 10 to 20 days. Therefore, the power quality is extremely demanding is high.

治理 方案

6 sets of 100A active filters are installed at the outlet end of the UPS to control the harmonics of polycrystalline furnace in a targeted manner.

Measurement items	National standard	Phase A		Phase B		Phase C	
		before	after	before	after	before	after
Total voltage distortion rateTHDu	l <5%	5.37%	1.49%	5.60%	1.44%	4.93%	1.47%
PF		0.94	0.98	0.94	0.78	0.92	0.97
5th harmonic current(A)	25.4	41.2	5.02	49.7	5.30	52	5.5
7th harmonic current(A)	21.6	32.6	4.25	34.0	4.10	34.22	4.6
11th harmonic current (A)	17.9	17.5	2.98	18.3	3.18	16.7	2.5

Data comparison before and after governance



