STATCOM
Model: AccuVar® ASVC–100/200
Beijing PONOVO POWER ADVANCED TECH.CO.,LTD is the high tech enterprise which specialize in technology development for power quality control and management, professional in developing and popularizing powerful electrical and electronics equipment. Beijing PONOVO POWER ADVANCED TECH.CO.,LTD is one of four mainstay industries company of Beijing PONOVO Company. Our company develops and manufactures equipments for control and manages power quality such as Static Var Compensator (SVC), Solid State Complex Switch (SSCS), Static Synchronous Compensator (SVG), Active Power Filter (APF), High-Voltage filter Compensator (FC) and Low Voltage Thyristor Switched Filter Compensator (TSF). Our productions already been widely applied in industries of metallurgy, rail way, wind power, mine and intelligent power grid.

Depending on long time technology accumulation, Beijing PONOVO succeeds in developing and manufacturing worldwide advanced electrical and electronics equipments. Company have established whole package of equipment simulation platform and equipment research strategy. Our company possesses electrical and electronics valve technology and technology for equipment design, experiment, adjustment and installation. Beijing PONOVO already has twenty one patents (sixteen of them are patented invention), twenty software copyrights and several national awards for science progress and IT industry invention.

Beijing PONOVO is capable for large scale production. Company’s head quarter locates in Beijing Zhongguancui high-tech industrial park, has project design center and research center. There are two manufacturing and experimental bases are located in Beijing and Chongqing. Our company has complete production line for electrical and electronic equipments, also has national laboratories for equipments working inspection, simulation and power system protection relay. Laboratories' total area is 7000m2. In 2012, Beijing PONOVO research & development center and industrial base will be put in service. The facility covers 46,000m2, has three main functions of research and development, global sale and service, manufacture products. PONOVO POWER ADVANCED TECH.CO.,LTD will become one of the best worldwide power system equipment manufacturer.

PONOVO has highly innovative team to lead our technical development. Most team members are academicians or doctoral supervisors, professors and senior engineers. They are all elite in field of electrical and electronics. We also have 300 staff with average age of 35 and 35% among them are having master degree or even higher degree, 30% of our staff are engineers and technicians.

In next five years, Beijing PONOVO will put more effort in developing technology for power quality management and relevant technology in area of intelligent power grid, keep introducing more advanced products to industries of metallurgy, electrified rail way, wind power. Dedicating ourselves for power saving and improving power quality in power transmission and distribution.
AccuVar ASVC has superior advantages compare with conventional fixed capacitor compensator, MCR and TCR.

1. Fast reactive power adjustment
AccuVar ASVC provides continuous dynamic compensation to power factor along the load variation. It completely eradicates capacitive reactive power delivery to the power grid and maintain power factor in designed value for power grid. AccuVar ASVC has advantages:
   (1) Fast response, able to implement dynamic compensation in real time.
   (2) Effectively avoid parallel resonance.
   (3) Able to produce and absorb reactive power.
   (4) Deliver less harmonic to system.

2. Restraining voltage fluctuation and flicker
Power grid voltage has fluctuation and flicker when high power impact load is operating. Voltage fluctuation and flicker bring negative influence to other nearby customers’ electricity usage and sensitive load by decreasing safety for electricity usage and decreasing efficiency for production, increasing risk of faulty production. AccuVar ASVC’s response time is less than 1ms and it provides smooth dynamic compensation for reactive power. It is more efficient to restrain voltage flicker and reduce voltage fluctuation, improve voltage to meet standard.

3. Constant current, effectively restrain voltage drop
AccuVar ASVC has characteristic of constant current. It has advantage in voltage control due to its reactive current output is not affected by busbar voltage. System needs more dynamic reactive power when system voltage gets lower. AccuVar ASVC’s reactive current output is not related to system voltage, but the conventional capacitor VAR compensator’s reactive power output is proportional to square value of voltage. AccuVar ASVC can provide better support for improving low voltage ride through (LVRT) characteristic in wind power.

4. Compensate negative sequence, implement balanced power supply
AccuVar ASVC has unique chained structure to allow split-phase adjustment and realizes energy interchange between different phases. It provides balanced compensation to load negative sequence by applying Steinmetz balanced principle. AccuVar ASVC makes current flow into system with balanced power and desired reactive power.

5. Resistance to harmonics, able to compensate the part of harmonic current
Due to widely applications of nonlinear load, harmonics threaten public power grid worse than before. Harmonics cause equipment overheating, insulation depletion, extra power loss, decrease efficiency of power system and electrical equipment. It also cause malfunction of protection relay and malfunction of automatic device, inaccuracy of measurement and interfere nearby communication system. It is possible to have fire hazard when 3rd harmonic flow through natural line and makes line overheat. AccuVar ASVC applies carrier phase shift multi-level PWM (Pulse Width Modulation) control strategy and its high frequency equivalent switch can filtering partial load harmonics without amplifying them and no harmonic resonance. It makes possible for multi-function in on equipment.

Equipment introduction
STATCOM (Static Synchronous Compensator, also known as SVG). It is an important device for Flexible AC Transmission System (FACTS), which is the third generation of dynamic VAR compensation device after FC, MCR, and TCR type of SVC (Static VAR Compensator). Its appearance represents the application of advanced technology for dynamic VAR compensation. It is also known as DSTATCOM when apply in power distribution. STATCOM is connected parallel in power grid and works as reactive current source. Its reactive current can be flexibly controlled and compensate reactive power for system automatically. It solves problem of harmonics interfere switching parallel capacitor banks. In another hand, it can restrain harmonics and improve power quality according to customers’ needs. STATCOM has superior performance in lots of aspect such as responding speed, stabelize voltage of power grid, reduce system power loss and harmonics, increase both transmission capacity and limit for transient voltage. It also has advantage of smaller in dimension.

STATCOM uses three phases powerful Voltage Sourced Converter as its core. Its voltage output connects system by through reactor or transformer. And regulates AC voltage amplitude and phase of inverter to absorb or produce reactive power for system. As sourced compensation device, STATCOM not only monitoring and compensates current for impact load but also compensate and monitoring harmonic current.

Depending on advantages of powerful technology and human resource, Beijing PONOVO introduces several types of STATCOM with different topology to meet customers’ various needs. AccuVar ASVC - 100 type of DSTATCOM applies chained-multilevel structure and featured with compact design, less power loss, fast respond and module configuration for easier expansion and maintenance. Major control system adopts DSP and FPGA with layered structure which enables high-speed adaptive computation, multi-chained expansion and flexible configuration for system. It has been applied in industry of coal mine, wind power system, metallurgy, electrified railway and power distribution for urban and rural area (suitable for power distribution system with 3kv to 35kv).

Main function

Technical features
- Provides fast smooth dynamic compensation from inductive to capacitive in reactive power. Also eradicates reactive power delivery to the power grid. It meets the maximum request to compensate power factor, keeps power factor close to 1.0 at anytime.
- Low power loss, better economical operation.
- Has powerful ability to support voltage and ability to withstand short-time overload. Provide better support for improving low voltage ride through (LVRT) characteristic in wind turbine. Decrease negative influence which caused by repetitive switching operation to the wind turbine.
Faster response time and better effect for restraining flicker.

Produce no harmonic and filtering partial load harmonic without amplifying harmonic and no harmonic resonance. It has better safety and stability due to it is not sensitive to the system parameters.

Modules designed, easy for installation and maintenance. Redundant N+1 structure provides high reliability.

Less space for installation, also provides flexible installation, equipment can be installed indoor/outdoor.

Low loss and low noise.

**Principle**

1. AccuVar ASVC circuit applies high power switch controlled electrical and electronics components to construct phase-change bridge circuit. The circuit connects through inductor in parallel with grid. To implement reactive compensation, adjust amplitude and phase of AC voltage or directly adjust AC current in bridge circuit to make circuit absorb or produce reactive current.

2. AccuVar ASVC has real power/reactive power exchange with system. This is implemented by control the amplitude and phase angle of chained converter voltage output.

3. AccuVar ASVC circuit connection shows below, phase converter is structured by chain knots

4. Converter's IGBT valve adopts optimize carrier phase-shift modulation. Multiple knots equivalent switch has high frequency and has extremely low harmonic output. Voltage output wave form shows below

**Equipment configuration**

AccuVar ASVC is mainly constructed by circuit breaker, arrester, reactors in series/step-up transformer, start-up circuit, chained modules, control and protection system, cooling system and other assistant circuits.

Indoor installation applies panel assembly structure which is mainly constructed by start-up cabinet, power cabinet, control protection cabinet, reactor cabinet. Outdoor installation applies whole container structure. For outdoor installation, the whole equipment has been preset in factory. It makes easier for equipment adjustment in work site and more adaptive to surroundings.
All components inside of Modules are exported productions, the high performance and high reliability are ensured. Membrane type capacitors are used as DC capacitors. The lifetime of equipment is increased although the cost of membrane type capacitor is higher than cost of electrolytic capacitor. The circuit for each knot is shown below:

AS figure shows, the circuit is constructed by H bridge, DC capacitors, control trigger circuit and other assistant circuits. Controller for each knot is positioning in high potential and communicates with main controller through optical fiber, the ability of anti-interference for system is improved in this way.

Control protection system applies advanced layered structure, using high speed digital signal processor (DSP) and large scale field programmable gate array (FPGA) to increase calculation speed for system. And system has flexible structure, easy for maintenance.

**Technical specification**

- **Rated frequency:** 50 Hz
- **Rated voltage:** 3kv/6kv/10kv/20kv/35kv
- **Rated capacity:** ±1 ~ ±18Mvar (ASVC-100) ±10 ~ ±50Mvar (ASVC-200)
- **Rang of reactive power adjustment:** capacitive ~ inductive continuous smooth adjusting
- **Overload capability:** running time for overload of 1.15 ≥ 30min
- **Controller response time:** ≤ 1ms
- **Voltage output THD before connecting with grid:** THD < 5%
- **Current output THD:** < 4%
- **Voltage output unsymmetrical degree:** < 3%
- **Running efficiency:** ≥ 99%
- **Power cabinet dimension:** 1200×1000×2400 (W×D×H)
- **Startup cabinet dimension:** 1200×1000×2400 (W×D×H)
- **Control cabinet dimension:** 800×800×2260 (W×D×H)
- **Surroundings temperature:** -40°C ~ +50°C
- **Installation structure:** indoor/box-type
- **Cooling system:** forced air cooling (ASVC-100)/sealed water cooling (ASVC-200)
- **Designed lifetime:** 30 years
**Application area**

**Urban power distribution and power supply for rural area**
- Improve power factor and reduce reactive power loss
- Restrain voltage fluctuation and flicker caused by fluctuating load
- Stabilize terminal voltage
- Suitable for concentrated compensation to harmonic caused by multiple users, especially for areas with impact loads

**Renewable energy connection**
- Control reactive power in power source connection point for wind power and photovoltaic power generation equipment
- Stabilize grid voltage, reduce voltage fluctuation caused by power variation during power generation
- Maintain voltage level in connection point, improve low voltage ride through (LVRT) characteristic

**Electrified railway and urban rail transportation industry**
- Control reactive power and manage harmonic for power supply systems, improve power quality, save power and reduce power loss
- Balance negative sequence current caused by locomotive load

**Steel and Metallurgy industry**
- Improve power factor and reduce reactive power loss
- Restraine voltage fluctuation and flicker, improve efficiency of production
- Filtering harmonic and keep equipment safety
- Balance negative sequence

**Heavy industry such as petrochemical industry, mine and harbor**
- Stabilize supply voltage
- Provide concentrated compensation for high/low power substation
- Provide on spot compensation for large scale motor
- Reduce fluctuation and harmonic for traction transmission device
- Concentrated compensation for equipments of heavy crane, ship-lock control system and forging

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