



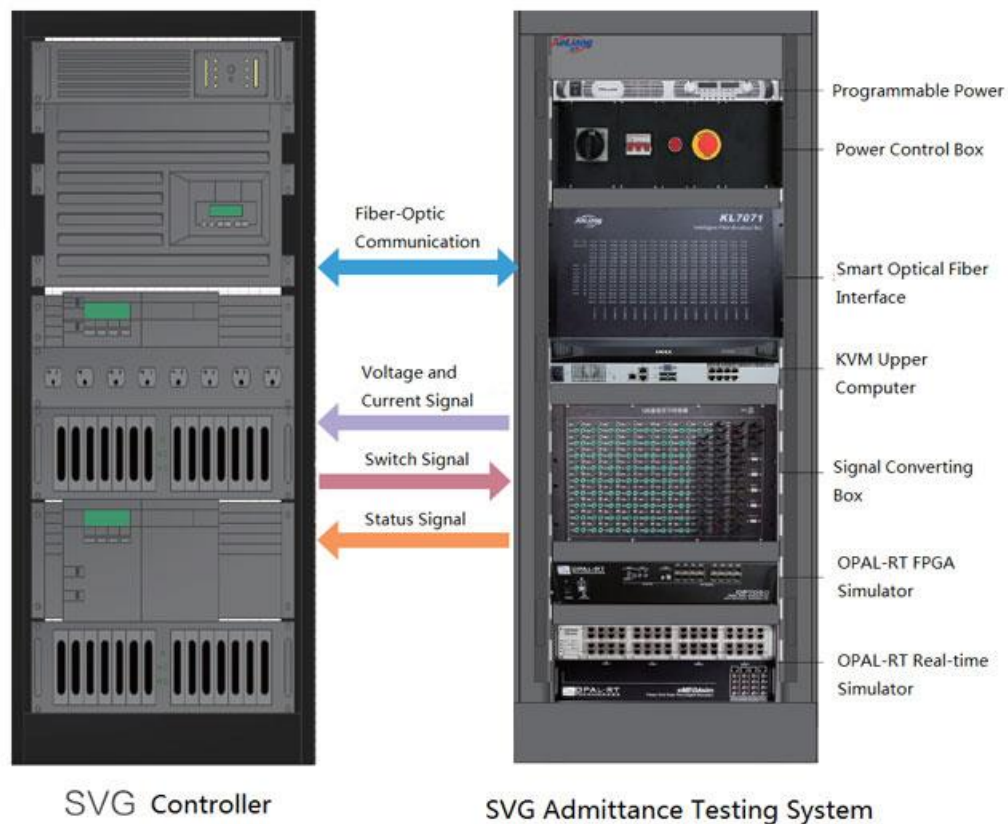
## **SVG Admittance Testing System**

## 1. Challenge

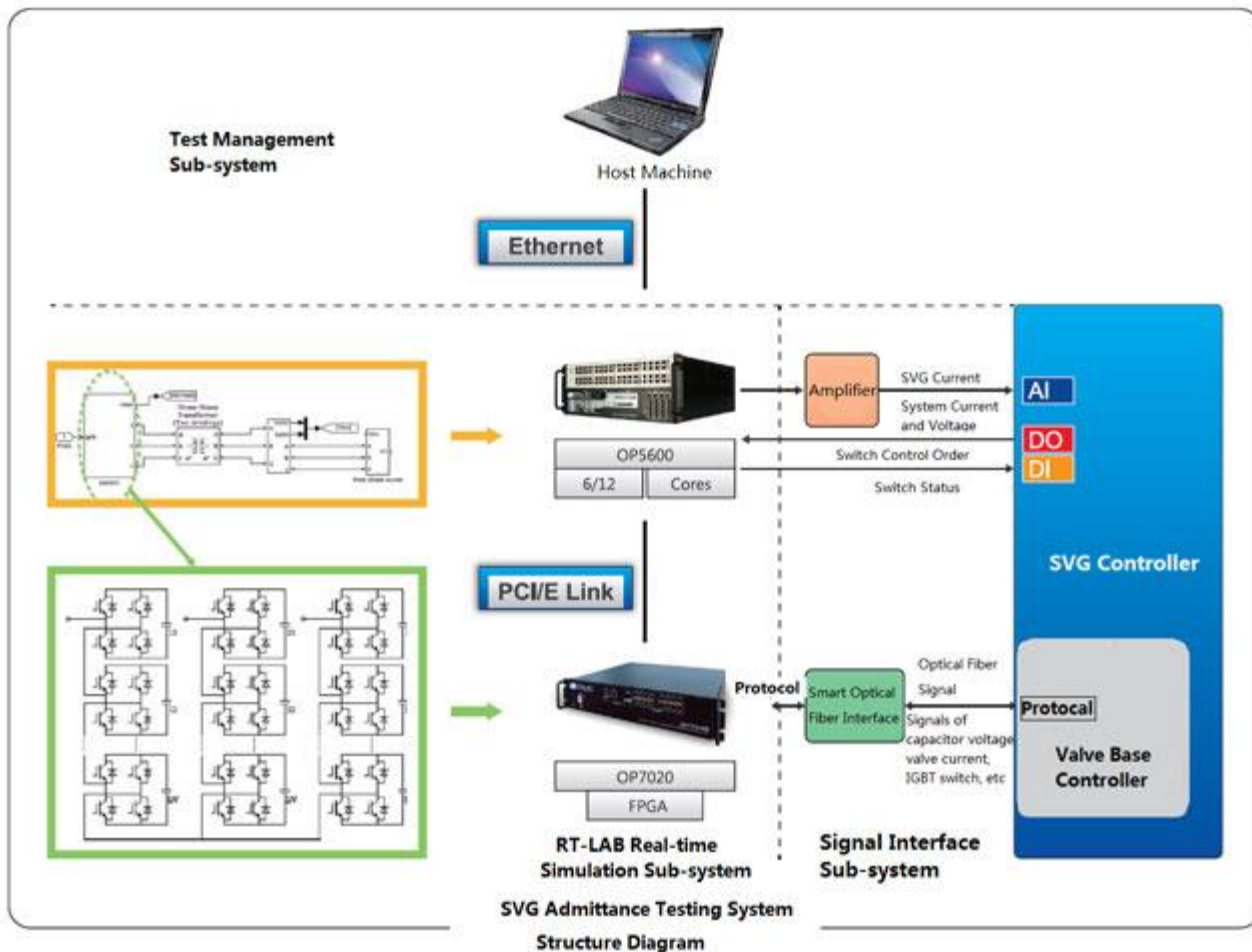
With the rapid development of modern grid, the integration of new energies, the operation of AC/DC hybrid power grid, and the widely use of non-linear loads and impact loads like high-voltage large-capacity power electric devices, the dynamic reactive problem of power grid is becoming more and more obvious. SVG (STATCOM: Static Synchronous Compensator) has recently been widely used, since it has the advantages of high-speed dynamic response and the excellent ability of voltage flicker suppression, etc.

However, there is no effective means or system of testing for SVG devices produced by different manufacturers. To solve the problem, Shanghai KELIANG Information Tech. & Eng. Co., Ltd. sums up years of engineering experience of application test in power electric and power system, and develops a SVG admittance testing system, which can effectively shorten the developing circle of SVG controller and provide stable and standard admittance test.

In their recent project, Guangdong Electric Power Research Institute adopts KELIANG's SVG Admittance System to test SVG performances like reactive power output, voltage stability, dynamic response, etc; and to test whether SVG's main performance index could meet the requirements of international standards and technical specifications, which thus provides stable guarantee for SVG's integrating into power grid.



## 2. Solution

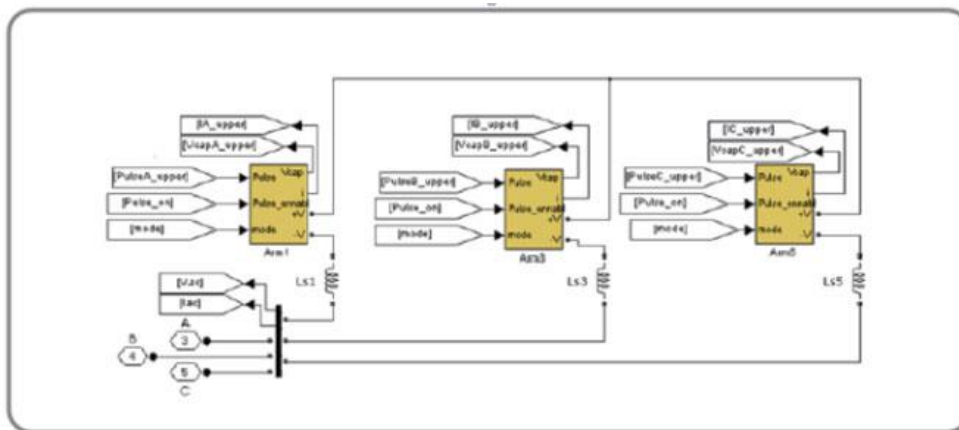


KELIANG SVG admittance testing system consists of three parts: Test management sub-system, RT-LAB real-time simulation sub-system and Signal Interface sub-system. It has the advantages like:

## Advanced Real-time simulation system

RT-LAB is adopted as the real-time simulation sub-system, it is based on multi-core distributed computing technology and FPGA high-speed digital signal processing technology, which is now the most advanced real-time simulation system.

## Accurate customized project model



The system possesses various detailed CPU or FPGA based power system models, which have been calibrated by actual projects. For example, FACTS model of SVG or UPFC, MMC-HVDC model, traditional power grid model and various new energy models, etc., customized test model according to client's needs is also available.

## Standard Automatic Testing Process

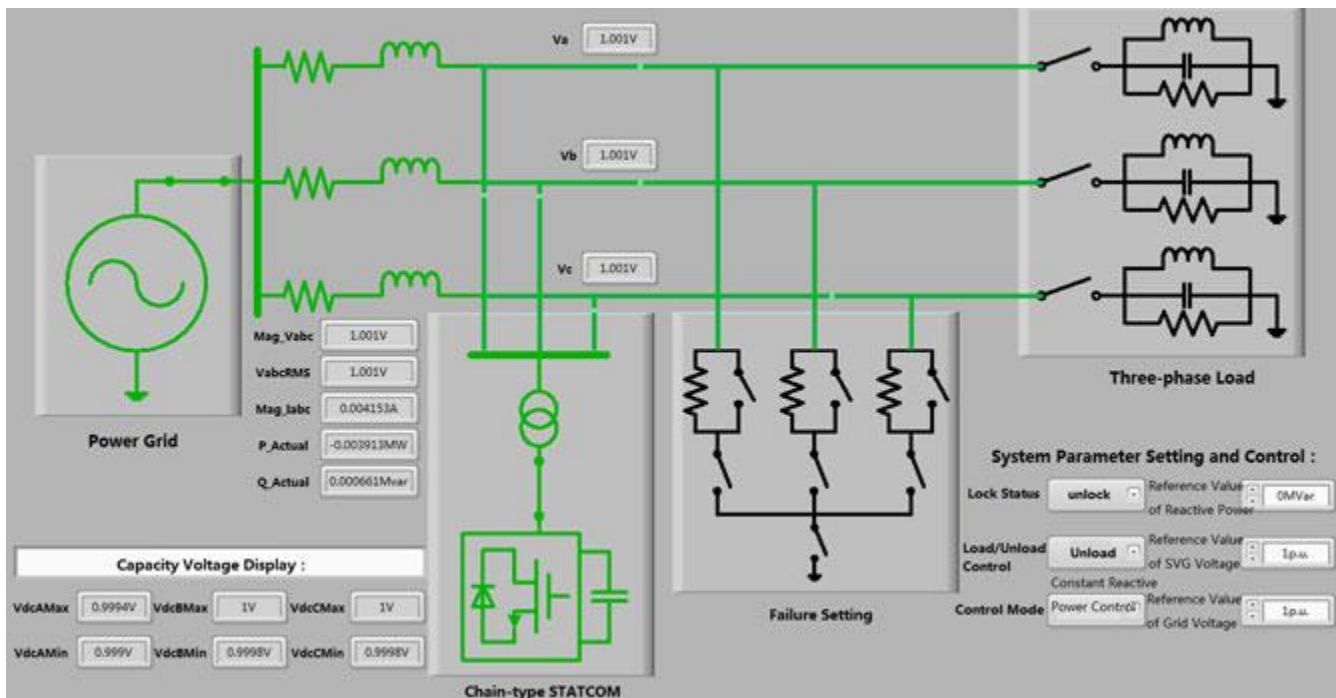
According to industry standards of SVG admittance test, and along with QuiKLab automatic test software that is developed by Keliang, an automatic testing process

specifically for SVG admittance test has been developed, which could realize the total automatic process from simulation analysis to test report generation.



### **Professional Man-Machine Interface**

According to standards of power system and using customs, the graphic man-machine interface we developed with LabVIEW makes operation more flexible, comfortable and convenient.



## 3. Achievement

The SVG system provided by KELIANG can perform the functions as below:

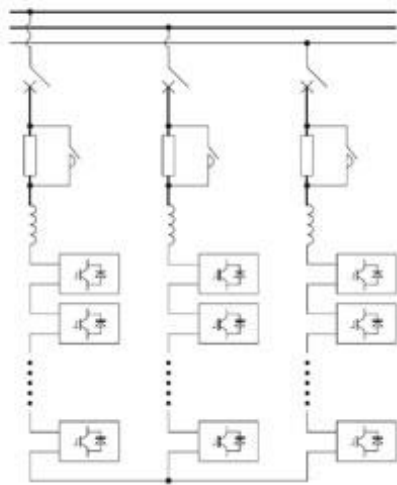
- At the phase of overall planning of SVG and communication system and the phase of SVG project parameter design, the system could use detailed SVG model to perform study and analysis of development and design phase, and to optimize SVG project parameter.

- At the design and development phase of SVG control logic and control algorithm, the system could conduct various control performance tests with detailed SVG model, and to optimize control logic and algorithm.
- After the design of SVG control and protection, this system could implement admittance test for SVG controller automatically or manually according to National Grid's industry standard Q/GDW241-2008 《Chain-type STATCOM (Static Synchronous Compensator) 》

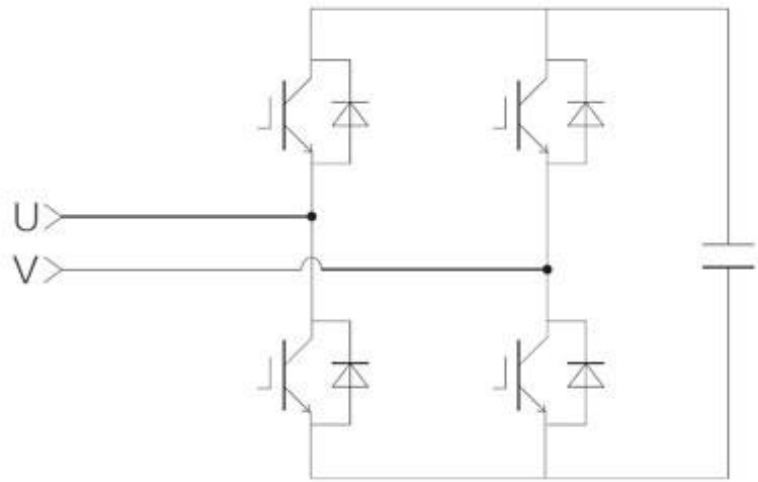
The contents of admittance test (manual or automatic) are as below:

Functional Test	Dynamic performance Test
<ul style="list-style-type: none"> <li>• SVG General control performance test</li> <li>• SVG start function test</li> <li>• SVG constant reactive power control function test</li> <li>• SVG constant voltage control function test</li> <li>• SVG control and protection device sampling test</li> <li>• SVG sub-module n-1 redundancy test</li> <li>• SVG mode switch test</li> <li>• SVG safe work area test</li> </ul>	<ul style="list-style-type: none"> <li>• SVG voltage, power, loads step response test</li> <li>• SVG open-loop control performance test</li> <li>• SVG constant reactive power control performance test</li> <li>• SVG constant voltage control performance test</li> <li>• SVG sub-module equal voltage control test</li> <li>• Dynamic response test of SVG control mode switch</li> <li>• Control performance test for SVG AC, DC and various power sub-module</li> <li>• SVG system failure response test</li> </ul>





Chain-type SVG Topology



Chain-type SVG power unit

KELIANG provided excellent CPU model, the simulation results corresponds totally to the actual situation, and various dynamic responses have well simulated the characteristics of grid and SVG. KELIANG has accomplished the whole SVG admittance test, verifying the control function and performance of SVG controller, which saves testing cost and increase testing efficiency for Guangdong Electric Power Research Institute. This system provided a perfect solution for SVG grid-connection test.