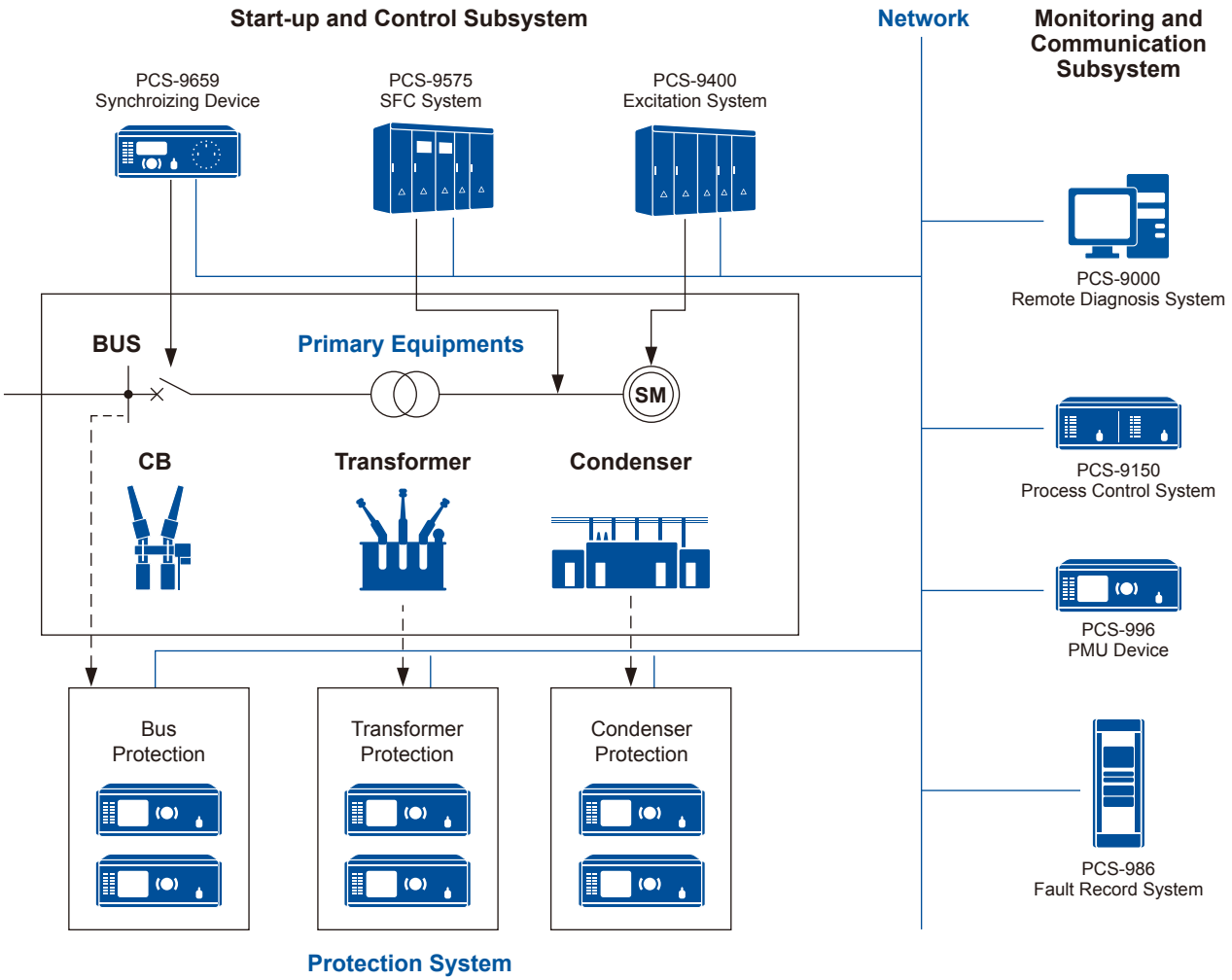
Synchronous Condenser Solution

All-in-one Solution

There is a must to install reactive power source for voltage control and power flow optimization and line loss reduction, due to more demand on reactive power as renewable power and HVDC transmission and centralized load grow fast in power grids. Synchronous condenser (hereinafter called SC), as a conventional reactive power compensator, has many inherent characteristics such as the strong fault-ride-through capability and the good rotating inertia and the reactive power regulation independent of system voltage. SC has more advantages for weak grid and underdamping network as compared with other reactive compensators.

SC is the latest generation of rotating motor with large overload ability and without mechanical load or prime motor. It can provide fast reactive power support as soon as the system operating voltage is beyond its normal range. It is capble of meeting the demand on subtransient, transient and stable reactive power, and is to suppress voltage fluctuation and fasten post-fault voltage recovery.

Schematic diagram of synchronous condenser solution



SC motor itself employs many special designs: the reduction of the number of stator slot and the change of stator and rotor slot structure and the increasement of stator length so as to meet the requirement on dynamic parameters; the enhancement of iron core insulation level and terminal shielding structure in order to fufill the demand on overvoltage due to leading-phase operation of stator winding; the installation of damping winding at rotor slot to improve the ability to withstand negative sequence current; the configuration of two AC oil pump and one dc oil pump for lubricating oil system; the dual design of control and protection contact; the water-cooling or air-cooling design of stator and rotor and iron core.

Synchronous condenser picture taken on site

As a world-famous provider of electric power automation solution, NR has so many years of experience in the technique research, product development, manufacturering, sales, and engineering service in the control and protection field of power network and power plant. What' s more, NR has possessed both the well-proven products of completely proprietary intellectual property and the prominet achievements, in the field of dc control and protection, generator excitation system, generator protection and static frequency converter, along with both the rich experience in large-scale project and the perfect quality control process.

Static frequency converter picture taken on site

NR has already sucessfully integrated synchronous motors with the secondary all-in-one solution of control and protection and automation in station, together with high-quality service in every process of project delivery.

Solution configuration

Synchronous condenser system includes four subsystems as follows:

Synchronous motor

- stator
- rotor
- oil system
- cooling system
- monitoring and sensing system
- communication interface

Start-up and control subsystem

- PCS-9575 static frequency converter
- PCS-9400 excitation system
- PCS-9659 synchronizing device

Monitoring and communication subsystem

- PCS-9150 process control system
- PCS-996 phase measurement unit
- PCS-9000 remote diagnosis system
- PCS-986 fault record system

Protection subsystem

- PCS-985 condenser protection
- PCS-987 torsional vibration protection

Solution features

Professional design of the entire solution

Tests for the entire solution of synchronous condenser are performed in physical model lab and real-time digital simulator lab and EMC lab in order to verify SC rating, control parameters, protection setting, and anti-interference measures. United simulation between SC system and power network is carried out with RTDs system to validate the control strategy and get optimum performance for the entire SC system.

Universal and reliable platform

UAPC based solution in hardware and software brings SC reliable operation and simplified maintenance.

Customized synchronous motor supply

The application experience and specialized understanding of synchronous condenser will make the design and manufacturering criteria for optimizing SC parameters and operation and ensure effective management for long-term opreation and maintenance.

Digitalization solution

Information sharing is realized with a dedicated protocol network to get high real-time data interaction, high reliablity, unified operation interface style, and simple operation and maintenance. The one-button function of start/stop and the local and remote diagnostic capacity let SC station have the unattended operation and the intelligent operation and maintenance.

High-integrated secondary solution

The SFC, excitation system, synchronizing device, DCS, remote diagnostic system, PMU, generator protection, torsional vibration protection, and fault record system for the synchronous condenser are all developed and manufacturered by NR. The automaitic operation and maintenance of the synchronous condenser is realized which is based on the unified design and flexible interface for its subsystems, so as to improve the entire automation level.

Main References

NR has delivered many synchronous condenser solutions with satisfactory performance, which includes the following references.

Outdoor picture of synchronous condenser on site

- 2 sets of synchronous condenser with each rated 300Mvar, at Xiangtan HVDC station
- 2 sets of synchronous condenser with each rated 300Mvar, at Taizhou HVDC station
- 3 sets of synchronous condenser with each rated 300Mvar, at Linyi HVDC station
- 2 sets of synchronous condenser with each rated 300Mvar, at Nanjing HVDC station
- 2 sets of synchronous condenser with each rated 300Mvar, at ±1100kV GuQuan HVDC station
- 2 sets of synchronous condenser with each rated 300Mvar, at Nanchang HVDC station
- 2 sets of synchronous condenser with each rated 300Mvar, at NanYuan subtation
- 2 sets of synchronous condenser with each rated 300Mvar, at NieGeZhuang subtation
- 2 sets of synchronous condenser with each rated 300Mvar, at QingHai ChaiDaMu HVDC station
- 2 sets of synchronous condenser with each rated 300Mvar, at TianShan HVDC station

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